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# Water Stewardship in Pakistan: Linking SDG Targets with Domestic Water Resilience

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## Executive Summary

Water scarcity is one of the most pressing issues facing Pakistan today. The country, which relies heavily on water from the Indus River system, is experiencing a steep decline in per capita water availability, now approaching critical thresholds. Factors such as population growth, inefficient water management, the impacts of climate change, and a lack of water storage capacity have severely strained the nation's water resources. As a result, Pakistan faces persistent challenges related to water quality, access, agricultural productivity, sanitation, and overall environmental sustainability. These issues are further compounded by poor governance, inadequate institutional frameworks, and limited data integration and transparency across sectors.

The water crisis in Pakistan has profound implications not only for its people but also for its broader socio-economic development. While national and provincial policies have been developed to address these issues, the implementation and effectiveness of these frameworks have been hampered by a lack of political will, institutional fragmentation, and insufficient financial resources. The country's water governance is further complicated by a fragmented approach to managing water resources across agriculture, industry, and urban areas. The absence of a unified and transparent system has led to inefficient water use, pollution, over-extraction of groundwater, and, ultimately, the degradation of the water supply systems that millions of Pakistanis depend on.

This policy brief explores Pakistan's existing water governance frameworks, focusing on the National Water Policy (NWP), the National Climate Change Policy (NCCP), the National Adaptation Plan (NAP), and other key legal and regulatory documents. The brief also examines how these policies align, or fail to align, with the United Nations Sustainable Development Goals (SDGs), particularly SDG 6, which seeks to ensure access to clean water and sanitation for all. The document discusses the critical need for integrated water resource management (IWRM) and highlights the challenges posed by Pakistan's inadequate infrastructure and institutional capacity to meet SDG 6 targets.

A critical aspect of this analysis is the need for improved governance at both national and transboundary levels. In particular, the brief addresses the role of the Indus Waters Treaty (IWT), which governs the allocation of water between India and Pakistan. Despite its success in averting conflict over water resources, the treaty is increasingly under strain due to changes in hydrology, population growth, and climate change. The brief stresses the importance of strengthening diplomatic efforts, enhancing data sharing and integration between both countries, and improving water storage capacity, both within Pakistan and across the shared basin.

Private sector involvement is also identified as a crucial component in solving Pakistan's water crisis. The brief presents case studies of private sector initiatives, such as Nestlé Pakistan's Water Stewardship Project, which focus on corporate responsibility and sustainable water management practices. These initiatives demonstrate the potential for collaborative action between the private sector, government, and civil society to achieve measurable improvements in water governance. However, the brief highlights the need for more robust mechanisms to hold

the private sector accountable and ensure that these efforts are aligned with national policy goals and SDG commitments.

Finally, the policy brief provides actionable recommendations for improving water governance in Pakistan. These recommendations range from short-term, immediate actions, such as piloting water stewardship in vulnerable districts, to medium- and long-term institutional reforms aimed at strengthening regulatory frameworks, improving water data systems, and scaling up sustainable water practices. Key recommendations include the creation of multi-stakeholder water governance bodies, the establishment of a national water data hub, and the mainstreaming of water stewardship principles into national policies and plans. The implementation of these recommendations will be critical for Pakistan to achieve its SDG 6 targets and ensure long-term water security.

The policy brief concludes by emphasizing the need for a holistic, integrated approach to water governance that transcends administrative and sectoral silos. This approach should prioritize transparency, accountability, and community engagement, with a focus on building institutional capacity and improving data-driven decision-making. Water stewardship provides a powerful framework for achieving these goals, ensuring that Pakistan's water resources are managed sustainably, equitably, and efficiently. Through coordinated efforts at the national, regional, and transboundary levels, Pakistan can create a more resilient water future for its citizens, agriculture, and ecosystems.

# 1. Background & Context

Pakistan's water security challenge is structural rather than episodic. Since independence, per capita renewable water availability has declined from roughly 5,000–5,600 m<sup>3</sup> per person per year in the early 1950s to below, or hovering near, the 1,000 m<sup>3</sup> “water scarcity” threshold in recent years (Janjua et al., 2021; Rana et al., 2025).<sup>1 2</sup> This decline reflects rapid population growth, limited new storage capacity, and long-standing inefficiencies in allocation and governance. With per capita availability now widely cited at approximately 885–1,100 m<sup>3</sup> per year, scarcity is no longer a prospective risk but an immediate constraint on economic development, public health, and social stability (UNDP, 2019; World Bank, 2019).<sup>3 4</sup>

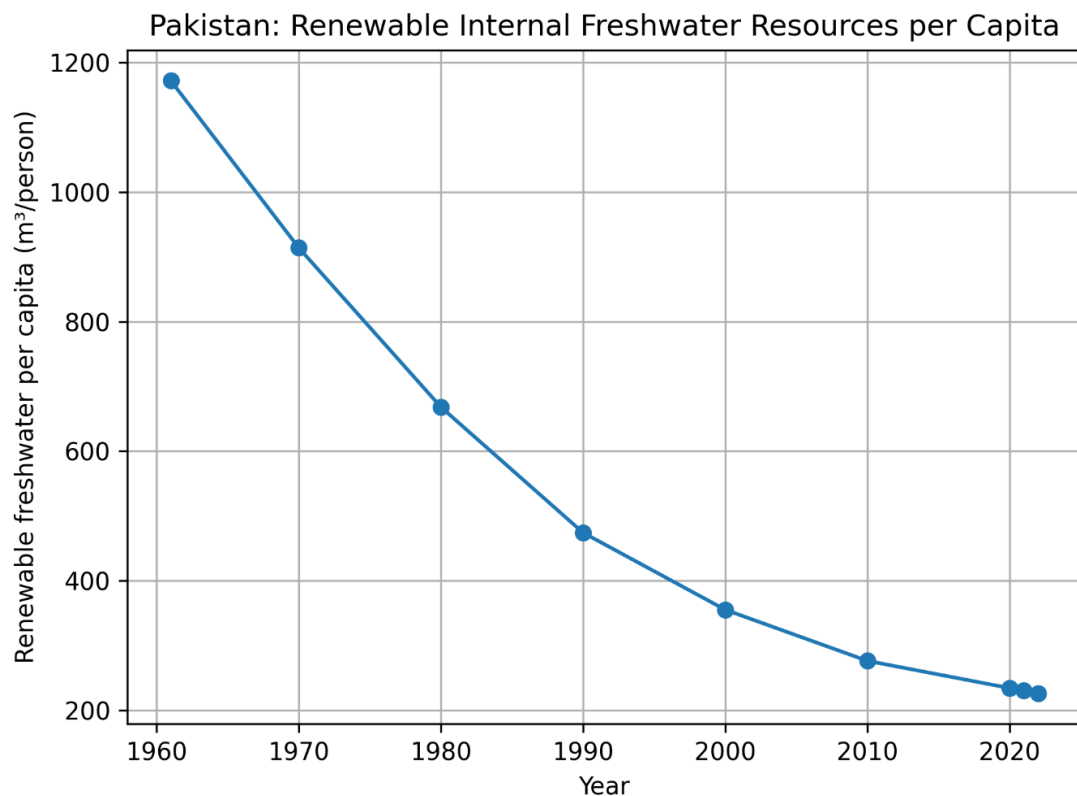


Figure 1: Decline in Pakistan's renewable internal freshwater resources per capita (1961–2022), showing a drop from over 1,100 m<sup>3</sup>/person to around 230–250 m<sup>3</sup>/person.

Source: World Development Indicators; FAO AQUASTAT<sup>567</sup>

<sup>1</sup> Janjua, S., Hassan, I., Muhammad, S., Ahmed, S., & Ahmed, A. (2021). Water management in Pakistan's Indus Basin: challenges and opportunities. *Water Policy*, 23(6), 1329–1343.

<sup>2</sup> Rana, S. A., Ali, S. M., Ashraf, M., Iqbal Gondal, N., Rahman, S., & Akhtar, N. (2025). Estimation of the domestic water demand–supply scenario and its key driving factors in the Islamabad–Rawalpindi Metropolitan Area, Pakistan. *PloS one*, 20(3), e0293927.

<sup>3</sup> UNDP. (2019). *Report on localization of SDG 6: Clean water and sanitation in Sindh*. [https://sindhsgds.gov.pk/wp-content/uploads/2023/09/SDG-6-Localization-Study-Final-Report-UNDP-Sindh-2019\\_v6.pdf](https://sindhsgds.gov.pk/wp-content/uploads/2023/09/SDG-6-Localization-Study-Final-Report-UNDP-Sindh-2019_v6.pdf)

<sup>4</sup> World Bank. (2019). *Pakistan: Getting more from water*. World Bank. <https://documents1.worldbank.org/curated/en/251191548275645649/pdf/133964-WP-PUBLIC-ADD-SERIES-22-1-2019-18-56-25-W.pdf>

<sup>5</sup> <https://databank.worldbank.org/Pakistan--Renewable-Freshwater-Resource/id/def9cce1?utm>

<sup>6</sup> <https://chartingtheglobe.com/region/pakistan/environment/water?indicator=renewable-water-per-capita&utm>

<sup>7</sup> <https://www.indexmundi.com/facts/pakistan/renewable-internal-freshwater-resources-per-capita?utm>

Water insecurity in Pakistan is compounded by quality degradation. National assessments indicate that a significant proportion of drinking water sources fail to meet safety standards, with contamination levels reported in large shares of sampled supplies (PILDAT, 2019).<sup>8</sup> The World Bank (2019) estimates that inadequate water supply, sanitation, and pollution contribute to substantial economic losses, approximately 4% of GDP annually, largely due to health burdens and disaster impacts. Waterborne diseases alone are associated with tens of thousands of child deaths per year. Thus, domestic water resilience is fundamentally a public health and economic issue.

Climate change amplifies this baseline scarcity by increasing hydrological volatility. Pakistan's freshwater system depends heavily on the Indus Basin, which is influenced by monsoon rainfall and cryosphere inputs from the Hindu Kush-Karakoram-Himalaya. Event-attribution and peer-reviewed studies link recent extreme rainfall and the 2022 mega-floods to anthropogenic climate change, highlighting intensified flood risk under warming scenarios (Nanditha et al., 2023).<sup>9</sup> Simultaneously, recurring drought conditions in arid and semi-arid regions, particularly Balochistan and parts of Sindh and southern Punjab, underscore persistent exposure to water deficits (Rafiq et al., 2023; Xie et al., 2013).<sup>10 11</sup>

Glacier and snowmelt dynamics introduce further uncertainty. The Upper Indus system is partly sustained by cryosphere contributions, yet glacier behaviour across High Mountain Asia is heterogeneous, shaped by complex regional climate interactions, including the so-called "Karakoram anomaly" (Farinotti et al., 2020; Giese et al., 2022; Lutz et al., 2016).<sup>12 13 14</sup> This variability means future river flows may not follow historical patterns, complicating planning for both storage and risk management. Pakistan therefore faces a flood-drought paradox: increasingly destructive floods alongside deepening seasonal and spatial water shortages.

Governance and demand trends intensify systemic vulnerability. The 2018 National Water Policy provides a federal framework, yet irrigation, agriculture, and water supply are largely provincial responsibilities, particularly following the 18th Constitutional Amendment. This has created coordination challenges between federal oversight and provincial implementation, often without adequate basin-scale integration mechanisms (Government of Pakistan, 2018; Saddiqa et al., 2022; UNDP, 2019).<sup>15 16</sup> Meanwhile, agriculture remains the dominant water user,

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<sup>8</sup> PILDAT. (2019, February). *Sustainable Development Goal 6: Ensure access to water and sanitation for all: Briefing paper*. Pakistan Institute of Legislative Development and Transparency. <https://pildat.org/wp-content/uploads/2019/04/SDG6.pdf>

<sup>9</sup> Nanditha, J. S., Kushwaha, A. P., Singh, R., Malik, I., Solanki, H., Chuphal, D. S., ... & Mishra, V. (2023). The Pakistan flood of August 2022: causes and implications. *Earth's Future*, 11(3), e2022EF003230.

<sup>10</sup> Rafiq, M., Cong Li, Y., Cheng, Y., Rahman, G., Zhao, Y., & Khan, H. U. (2023). Estimation of regional meteorological aridity and drought characteristics in Baluchistan province, Pakistan. *Plos one*, 18(11), e0293073.

<sup>11</sup> Xie, H., Ringler, C., Zhu, T., & Waqas, A. (2013). Droughts in Pakistan: a spatiotemporal variability analysis using the Standardized Precipitation Index. *Water international*, 38(5), 620-631.

<sup>12</sup> Farinotti, D., Immerzeel, W. W., de Kok, R. J., Quincey, D. J., & Dehecq, A. (2020). Manifestations and mechanisms of the Karakoram glacier Anomaly. *Nature geoscience*, 13(1), 8-16.

<sup>13</sup> Giese, A., Rupper, S., Keeler, D., Johnson, E., & Forster, R. (2022). Indus River Basin glacier melt at the subbasin scale. *Frontiers in Earth Science*, 10, 767411.

<sup>14</sup> Lutz, A. F., Immerzeel, W. W., Kraaijenbrink, P. D., Shrestha, A. B., & Bierkens, M. F. (2016). Climate change impacts on the upper Indus hydrology: sources, shifts and extremes. *PloS one*, 11(11), e0165630.

<sup>15</sup> Government of Pakistan. (2018). *National water policy 2018* (Policy Document). Ministry of Water Resources. <https://mowr.gov.pk/SiteImage/Misc/files/National%20Water%20Policy.pdf>

<sup>16</sup> Saddiqa, A., Batool, S., Gill, S. A., & Khan, A. J. (2022). Water governance and management in the 21st century: a case study of Pakistan. *Pakistan Journal of Humanities and Social Sciences*, 10(1), 29-42.

consuming approximately 90% of withdrawals, with four major crops accounting for most of the irrigation demand despite relatively modest contributions to GDP (Siyal et al., 2023; World Bank, 2019).<sup>17</sup> Rapid urbanization and industrial expansion are further increasing pressure on already stressed systems. The National Adaptation Plan projects a potential 60% increase in national water demand by 2047 if current patterns persist, primarily driven by agricultural expansion and rising temperatures (Government of Pakistan, 2023).<sup>18</sup>

Taken together, declining per capita availability, deteriorating water quality, escalating climate extremes, fragmented governance, and rising sectoral demand create a structural water security dilemma. Water stewardship, defined as coordinated, basin-scale management integrating efficiency, equity, ecosystem protection, and climate resilience, emerges not as a discretionary sustainability concept, but as an operational necessity to bridge national development priorities with Sustainable Development Goal (SDG) commitments (Mumtaz et al., 2025; World Bank, 2019).<sup>19</sup>

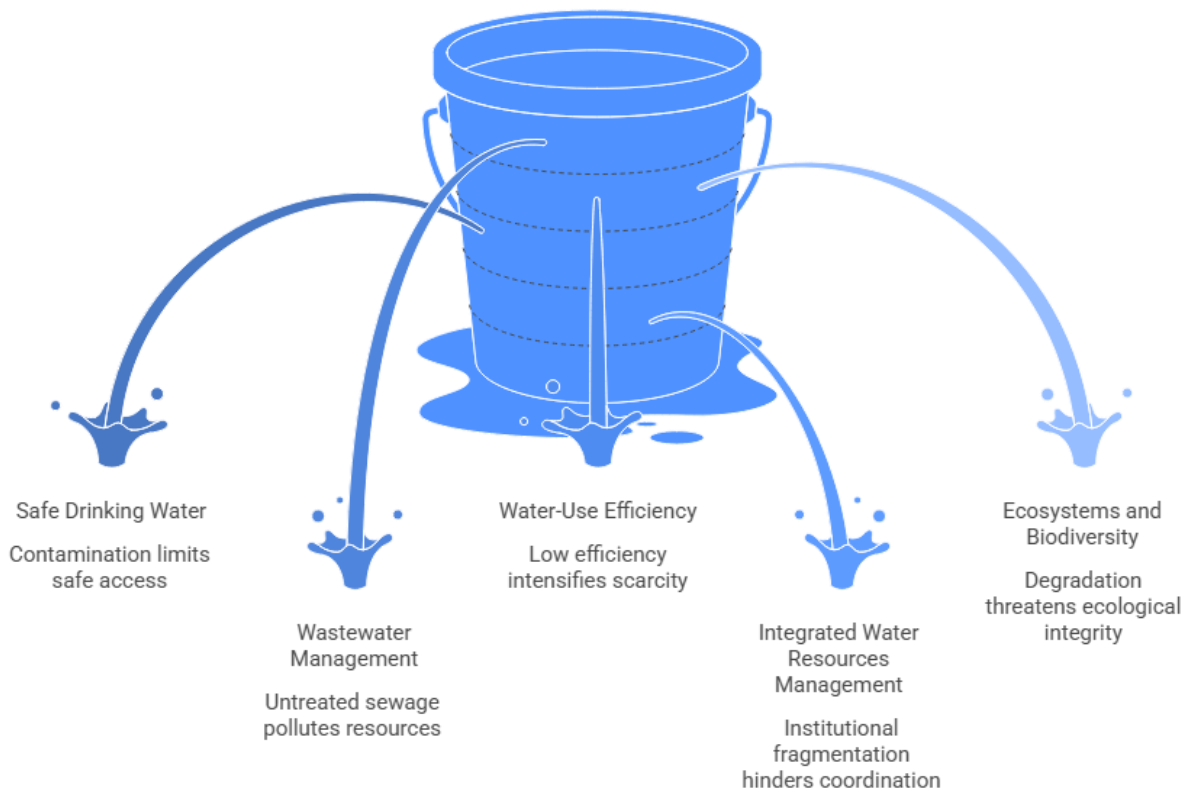


Figure 2: A multifaceted challenge of Pakistan's water crisis.

Source: Author's own analysis

<sup>17</sup> Siyal, A. W., Gerbens-Leenes, P. W., & Vaca-Jiménez, S. D. (2023). Freshwater competition among agricultural, industrial, and municipal sectors in a water-scarce country. Lessons of Pakistan's fifty-year development of freshwater consumption for other water-scarce countries. *Water Resources and Industry*, 29, 100206.

<sup>18</sup> Government of Pakistan. (2023). *National adaptation plan of Pakistan*. Ministry of Climate Change. [https://unfccc.int/sites/default/files/resource/National\\_Adaptation\\_Plan\\_Pakistan.pdf](https://unfccc.int/sites/default/files/resource/National_Adaptation_Plan_Pakistan.pdf)

<sup>19</sup> Mumtaz, T., Shaiq, S., & Afzal, M. (2025). Securing Sustainable Development Goal-6 in Pakistan: A Framework for Clean Water and Sanitation. *Regional Lens*, 4(1), 67-78.

## 2. Methodology

This policy brief is grounded in a comprehensive review and synthesis of available literature, reports, and stakeholder consultations. The following steps were undertaken to ensure a thorough and balanced analysis, as illustrated in Figure 1:

- a. **Document Review:** A detailed review of academic articles, development reports, project evaluations, and relevant government publications was conducted. These documents provided insights into Pakistan's water governance framework, SDG commitments, policy challenges, and existing water stewardship initiatives. The documents reviewed include national policy frameworks, SDG reports, and sector-specific publications that relate to water management, sustainability, and climate resilience.
- b. **Stakeholder Engagement:** To gather practical insights and ensure diverse perspectives, a webinar titled "Gender-Responsive Water Stewardship: Policy, Practice and Pathways" was organized by the Sustainable Development Policy Institute (Appendix 01). The event brought together representatives from government, development partners, civil society, the private sector, and academia to discuss challenges and opportunities in water governance and stewardship in Pakistan. The discussions highlighted policy implementation gaps and the importance of inclusive and gender-responsive water management, providing valuable inputs and recommendations that informed this policy brief.
- c. **Data Synthesis and Analysis:** The data and findings from the reviewed reports and webinars were systematically analyzed to identify key themes, trends, and gaps in water governance and stewardship. The analysis was structured around the primary objectives of this policy brief: addressing operational challenges in water governance, linking SDG commitments to on-the-ground implementation, and identifying actionable policy recommendations.
- d. **Case Study Integration:** Case studies of ongoing projects, such as the PepsiCo and Nestlé water stewardship initiatives in collaboration with the Sustainable Development Policy Institute (SDPI), were integrated into the analysis. These case studies provided real-world examples of how water stewardship can be successfully implemented at the community level and highlighted the role of the private sector in addressing water challenges.
- e. **Policy and Governance Review:** The policy brief also reviewed existing national policies such as the National Water Policy (NWP), the National Climate Change Policy (NCCP), and the National Adaptation Plan (NAP), identifying their strengths, weaknesses, and alignment with SDG 6 and other interlinked SDGs. Gaps in institutional coordination, data integration, and local capacity were identified to propose targeted recommendations for improving water stewardship practices across the country.

This methodological approach ensured a well-rounded and evidence-based policy brief, reflecting both expert opinions and real-world experiences, which are critical for addressing Pakistan's water governance and stewardship challenges.

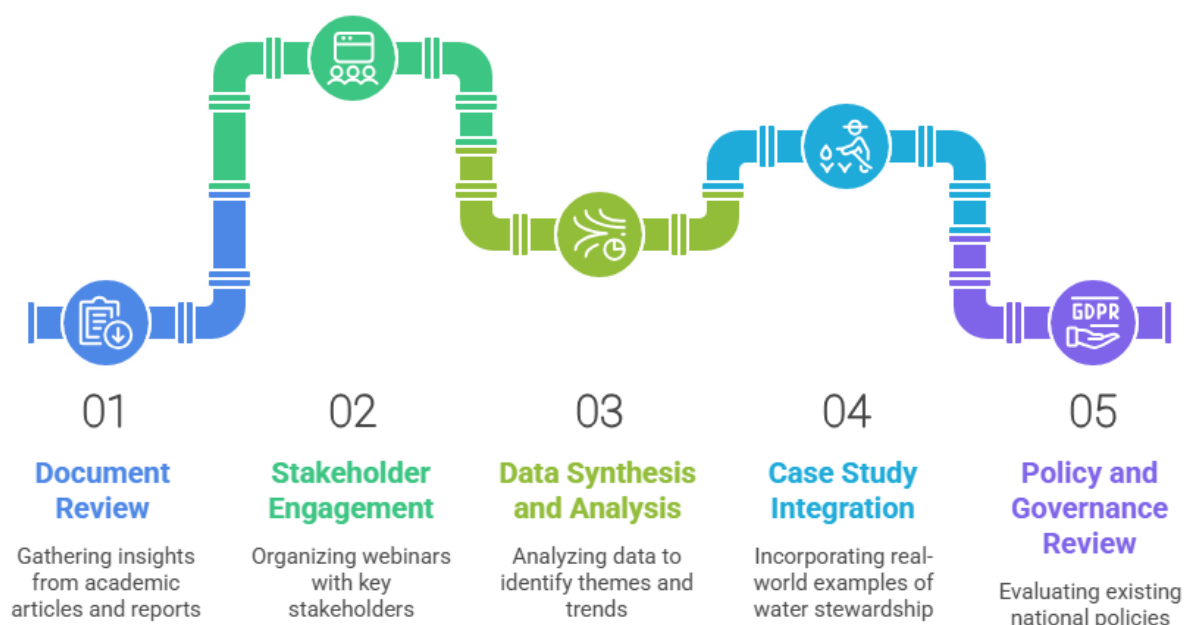


Figure 3: The methodology employed for this policy brief.

### 3. Water Governance, Policies, and Legal Framework in Pakistan

The following table highlights key federal policies and legal instruments shaping water governance, their intended outcomes, major implementation gaps, relevant SDG targets, and potential water stewardship entry points.

| Policy / Act                      | Key provisions / intended outcomes                                                                                                                                                                                               | Major implementation & governance gaps                                                                                                                                                                                                                      | Relevant SDG targets                                                         | Water stewardship entry points                                                                                                                                              |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Indus Waters Treaty (1960)</b> | Allocates waters of the Indus River system between India and Pakistan; establishes the Permanent Indus Commission and dispute resolution mechanisms under World Bank auspices to ensure cooperative management of shared rivers. | Recent suspension/abeyance of cooperation, withholding of hydrological data, and upstream project approvals without shared oversight weaken predictability and risk management; limited mechanisms for climate-informed data sharing and joint forecasting. | SDG 6.a; SDG 17.16 (international cooperation); SDG 6.5 (IWRM across basins) | Renew transboundary data exchange; basin harmonised forecasting and shared monitoring platforms; diplomatic engagement on basin governance tied to climate risk management. |

|                                                                   |                                                                                                                                                                                                |                                                                                                                                                                                                                   |                                                     |                                                                                                                                                                                  |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Water Apportionment Accord (1991)</b> <sup>20</sup>            | Establishes provincial surface-water shares and shortage/surplus principles.                                                                                                                   | Persistent inter-provincial tensions and disputes over surplus and shortage definitions, combined with climate variability, strain historically fixed water allocation arrangements.                              | SDG 6.5; SDG 16.6.                                  | Stewardship can provide “transparent accounting” (water budgets, monitoring) and build trust through shared data protocols.                                                      |
| <b>Indus River System Authority Act (1992)</b> <sup>21</sup>      | Creates Indus River System Authority to regulate and monitor distribution consistent with the Accord.                                                                                          | Institutional path dependence, centralization tensions, and recurring allocation disputes limit adaptive management under changing hydrological conditions.                                                       | SDG 6.5.                                            | Strengthen basin-scale monitoring, incorporate environmental flows and drought contingency rules via multi-stakeholder processes.                                                |
| <b>Pakistan Environmental Protection Act (1997)</b> <sup>22</sup> | Establishes environmental governance and compliance tools, including environmental assessment and regulation of pollutants.                                                                    | Enforcement constraints and uneven provincial capacity weaken environmental governance and regulatory compliance.                                                                                                 | SDG 6.3; SDG 3.9.                                   | Stewardship can link compliance to joint monitoring of industrial discharge, shared labs, and public disclosure.                                                                 |
| <b>Pakistan Climate Change Act, 2017</b> <sup>23</sup>            | Establishes institutional architecture (Climate Change Council and Authority) to coordinate national climate policy, including adaptation in water, agriculture, and disaster risk management. | Limited staffing and budget; weak vertical integration with provincial and district institutions; climate considerations are still often added after project design rather than mainstreamed into water planning. | SDG 13.1, 13.3; crosscutting with SDG 6 and SDG 11. | Mandating climate-risk screening for all large water and irrigation projects; integrating water security metrics into NDC and BTR processes; joint climate-water data platforms. |

<sup>20</sup> [https://irrigation.sindh.gov.pk/files/books/water\\_apportionment\\_accord\\_1991.pdf](https://irrigation.sindh.gov.pk/files/books/water_apportionment_accord_1991.pdf)

<sup>21</sup> [https://www.na.gov.pk/uploads/documents/1334288668\\_263.pdf](https://www.na.gov.pk/uploads/documents/1334288668_263.pdf)

<sup>22</sup> <https://na.gov.pk/uploads/documents/Pakistan%3DEnvironmental-Protection-Act-1997.pdf>

<sup>23</sup> [https://unfccc.int/sites/default/files/resource/National\\_Adaptation\\_Plan\\_Pakistan.pdf](https://unfccc.int/sites/default/files/resource/National_Adaptation_Plan_Pakistan.pdf)

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|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>National Water Policy (NWP), 2018<sup>24</sup></b>           | Establishes a national framework for water security; prioritizes drinking water and sanitation, irrigation efficiency, groundwater regulation, environmental flows, flood management, and wastewater treatment and reuse.                                                   | Policy remains largely framework-level; no fully empowered federal water commission with binding authority; weak enforcement of groundwater regulation and environmental flows; limited translation into provincial master plans and budgets. | SDG 6.1, 6.3, 6.4, 6.5, 6.6; SDG 11.5, 11.6; SDG 13.1. | Operationalizing basin-level IWRM; formalizing water-allocation plans; implementing volumetric pricing pilots; incentivizing wastewater reuse; multi-stakeholder basin platforms linking provinces, local governments, farmers, and industry. |
| <b>National Climate Change Policy (NCCP), 2021<sup>25</sup></b> | Recognizes water resources as highly climate-sensitive due to reliance on snow/glacier melt and monsoon rains; calls for more storage, rehabilitation of irrigation infrastructure, groundwater protection, rainwater harvesting, and integrated water resource management. | Fragmented execution across ministries and provinces; weak enforcement of groundwater controls and land-use measures; limited investment in small and medium storage and urban resilience despite policy recognition.                         | SDG 6.4, 6.5, 6.6; SDG 11.5; SDG 13.1, 13.3.           | Climate-informed reservoir and canal operation rules; aquifer recharge initiatives; city-level climate-resilient WASH planning; linking NCCP actions with SDG 6 and NWP monitoring frameworks.                                                |
| <b>National Adaptation Plan (NAP), 2023<sup>26</sup></b>        | Identifies water-agriculture nexus as priority; projects ~60% increase in water demand by 2047; proposes climate-smart                                                                                                                                                      | NAP is recently and still being operationalized; financing pipelines, sectoral investment plans, and local implementation arrangements (especially at district/tehsil level) are not yet fully                                                | SDG 2.3, 2.4; SDG 6.4, 6.6; SDG 12.2; SDG 13.1.        | Embedding water-stewardship standards into climate-smart agriculture programs; co-designing adaptation investments with farmer organizations;                                                                                                 |

<sup>24</sup> [https://ffc.gov.pk/wp-content/uploads/2018/12/National-Water-Policy-April-2018-FINAL\\_3.pdf](https://ffc.gov.pk/wp-content/uploads/2018/12/National-Water-Policy-April-2018-FINAL_3.pdf)

<sup>25</sup> [https://mocc.gov.pk/SiteImage/Policy/NCCP Report.pdf](https://mocc.gov.pk/SiteImage/Policy/NCCP%20Report.pdf)

<sup>26</sup> [https://unfccc.int/sites/default/files/resource/National\\_Adaptation\\_Plan\\_Pakistan.pdf](https://unfccc.int/sites/default/files/resource/National_Adaptation_Plan_Pakistan.pdf)

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|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                        | irrigation, improved storage and conservation, and better water distribution mechanisms; emphasizes integrated watershed management and water quality.                                                                   | defined; monitoring indicators are still evolving.                                                                                                                                                      |                                            | piloting climate-resilient canal and groundwater management in vulnerable districts.                                                                                                                  |
| <b>National Drinking Water and Sanitation Policies<sup>27 28</sup></b> | Aim to expand safe drinking-water coverage, improve rural and urban sanitation, and promote wastewater treatment in alignment with SDG 6; emphasize adoption of water safety plans and regular water-quality monitoring. | Less than 1% of wastewater is treated before disposal; water-quality surveillance is patchy; many schemes lack O&M financing; rural areas in particular face persistent service gaps and contamination. | SDG 6.1, 6.2, 6.3; SDG 3.3, 3.9; SDG 11.6. | City- and district-level water-safety planning; performance-based contracts for utilities; participatory monitoring of water quality; targeted sanitation investments in high-burden rural districts. |

Beyond these national frameworks, a patchwork of provincial irrigation and canal laws and utility by-laws govern the operation of canals, water user associations, and urban service providers, often with limited explicit alignment to SDG indicators or modern stewardship principles. These legacy frameworks tend to focus on infrastructure operation and revenue collection rather than on integrated basin management, ecosystem services, or equitable access for marginalized groups (World Bank, 2019; Mumtaz et al., 2025).

### 3.1 Transboundary Water Governance and the Indus Waters Treaty

The Indus Waters Treaty (IWT) of 1960 has historically been one of the most durable international water-sharing agreements, allocating the waters of the Indus River system between Pakistan and India via a legally binding framework with dispute resolution mechanisms under World Bank oversight. Under the treaty, waters of the western rivers (Indus, Jhelum, Chenab) were allocated

<sup>27</sup> <https://pildat.org/wp-content/uploads/2019/04/SDG6.pdf>

<sup>28</sup> [https://sindhsgs.gov.pk/wp-content/uploads/2023/09/SDG-6-Localization-Study-Final-Report-UNDP-Sindh-2019\\_v6.pdf](https://sindhsgs.gov.pk/wp-content/uploads/2023/09/SDG-6-Localization-Study-Final-Report-UNDP-Sindh-2019_v6.pdf)

for Pakistan's primary use, while eastern rivers (Ravi, Sutlej, Beas) were allocated to India, and the Permanent Indus Commission was established to manage technical cooperation and conflict resolution. Consequently, the IWT ensured predictable access to water that underpins about 80 % of Pakistan's irrigated agriculture, hydropower generation, and domestic and industrial water needs, embedding transboundary cooperation into the fabric of Pakistan's water security architecture.<sup>29</sup>

Recent disruptions to treaty mechanisms, including the suspension of cooperative engagement by India, withholding of hydrological data and advance notifications, and accelerated approvals of upstream infrastructure, have strained this framework, raising water security concerns for Pakistan's agricultural and energy sectors while undermining transparency and risk-informed basin governance.<sup>30 31</sup> From a water stewardship perspective, transboundary agreements like the IWT are not just geopolitical instruments but integral components of shared basin governance that must evolve to incorporate cooperative data integration, joint flood forecasting, and climate adaptation planning across hydrological boundaries. Enhancing Pakistan's diplomatic engagement to restore cooperative mechanisms and data sharing under the IWT, while investing domestically in expanded storage capacity and watershed infrastructure (beyond limited existing reservoirs such as Tarbela and Mangla), would simultaneously strengthen resilience to seasonal variability and align basin governance with SDG 6.5 on shared management, SDG 6.a on international cooperation, and global norms for equitable transboundary water stewardship.<sup>32 33</sup>

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<sup>29</sup> <https://sarasijmajumder.in/indus-water-treaty-a-review/>

<sup>30</sup> <https://www.reuters.com/world/asia-pacific/india-says-it-will-never-restore-indus-water-treaty-with-pakistan-2025-06-21/>

<sup>31</sup> <http://tribune.com.pk/story/2587979/indias-suspension-of-indus-waters-treaty-international-law-and-pakistans-right-of-self-defence?>

<sup>32</sup> <https://www.planetarysecurityinitiative.org/news/indus-water-treaty-2025-pause-cooperation-not-end?>

<sup>33</sup> <http://natstrat.org/articledetail/publications/the-indus-waters-treaty-why-pakistan-s-obsession-does-not-mask-its-failure-158.html?>

## 4. SDG Framework and Pakistan's Commitments

### 4.1 Core SDG 6 Targets

#### a. SDG 6.1 – Safe and affordable drinking water

Pakistan has expanded access to “improved” water sources over the past two decades; however, safely managed drinking water remains limited in both urban and rural contexts. National monitoring by the Pakistan Council of Research in Water Resources (PCRWR), summarized in SDG 6 policy assessments, indicates that between 69% and 85% of sampled drinking-water sources in various cities and rural schemes were contaminated, primarily with microbial indicators such as *E. coli* (PILDAT, 2019; Government of Pakistan, 2019). This suggests that infrastructure expansion has not been matched by sustained quality control, source protection, or safe distribution.

The Sindh SDG 6 localization study reports national per capita water availability at approximately 885 m<sup>3</sup> per year and estimates that only around 36% of water supplies consistently meet national quality standards (UNDP, 2019). These figures reflect a systemic gap between coverage and safety. Pakistan's Voluntary National Reviews (VNRs) in 2019 and 2022 acknowledge progress in scheme installation and filtration plant construction but recognize persistent challenges in reliability, equitable access, and quality regulation, particularly for rural communities and informal urban settlements (GoP, 2019, 2022).<sup>34 35</sup>

The key structural issue is not solely supplying augmentation but governance of service delivery. Intermittent piped systems increase contamination risk; poor maintenance and limited cost recovery undermine sustainability; and monitoring data are not consistently integrated into regulatory action. Progress under SDG 6.1 therefore requires shifting from infrastructure-led approaches to risk-managed, quality-assured service models.

#### b. SDG 6.3 – Water quality and wastewater management

Wastewater management represents one of Pakistan's most critical SDG 6 deficits. National assessments consistently indicate that less than 1% of municipal wastewater is treated before disposal, with untreated sewage commonly discharged into open drains, canals, and rivers (PILDAT, 2019). This practice contributes to widespread biological and chemical contamination of both surface water and shallow groundwater resources.

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<sup>34</sup> Government of Pakistan. (2019). *Pakistan's implementation of the 2030 Agenda for Sustainable Development: Voluntary national review*. Government of Pakistan. <https://pc.gov.pk/uploads/report/VNR%20Report%20-%20Sep%202019%20final.pdf>

<sup>35</sup> Government of Pakistan. (2022). *Voluntary national review 2022: Pakistan's implementation of the 2030 Agenda for Sustainable Development*. Government of Pakistan. <https://www.pc.gov.pk/uploads/report/VNR-v9.pdf>

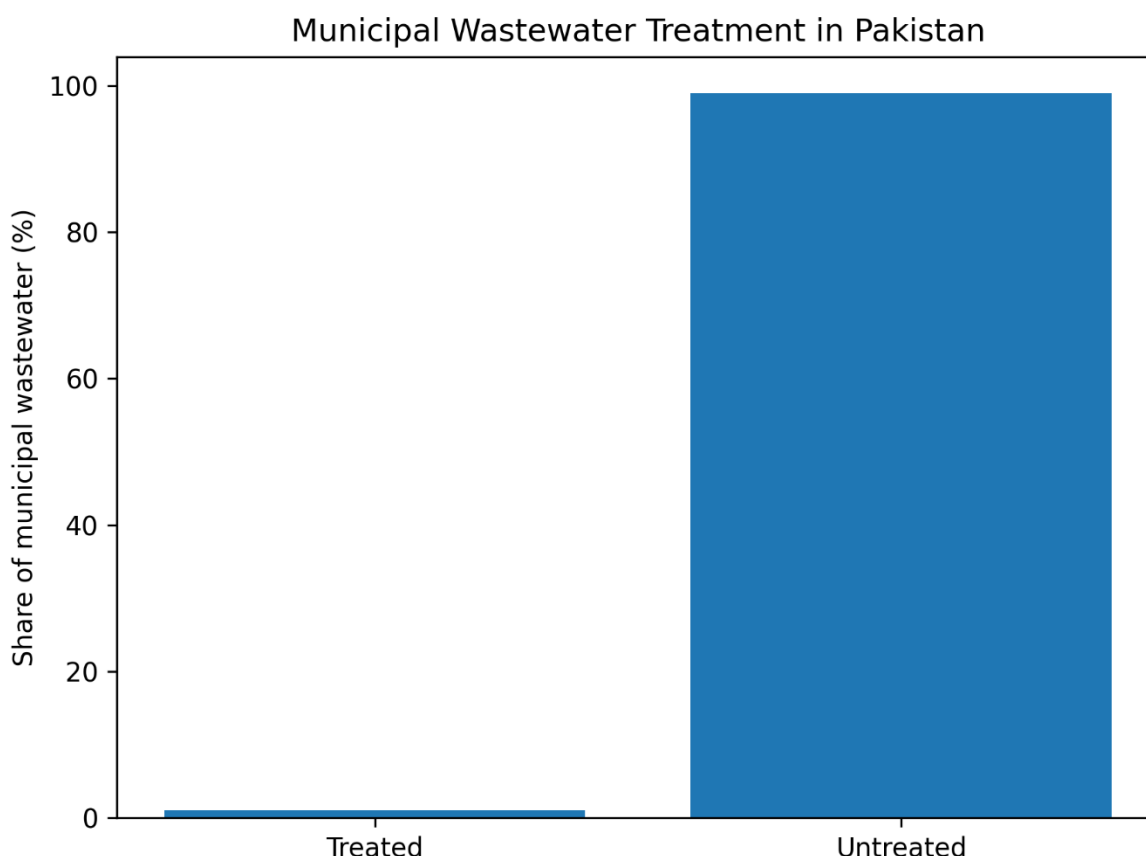


Figure 4: Estimated share of municipal wastewater treated vs untreated in Pakistan, illustrating that less than 1% receives treatment before disposal.

Source: PILDAT (2019); World Bank (2019).

The resulting public health and economic costs are substantial. The World Bank (2019) links poor water quality and sanitation to significant morbidity, mortality, and economic loss, estimating that water-related health burdens and environmental degradation impose costs equivalent to approximately 4% of GDP annually. Elevated rates of diarrhoeal disease and other waterborne infections remain strongly associated with unsafe supply and wastewater contamination (World Bank, 2019; PILDAT, 2019).

The National Water Policy (NWP) explicitly calls for wastewater treatment, reuse strategies, and strengthened water-quality monitoring systems (GoP, 2018). However, enforcement of discharge standards and investment in treatment infrastructure remain far below stated policy ambitions. The Sindh SDG 6 localization study similarly identifies wastewater management as a priority gap, recommending provincial strategies aligned with SDG 6.3 targets (UNDP, 2019).

Analytically, the constraint is not policy absence but implementation capacity and financial structuring. Wastewater treatment requires not only capital investment but institutional models for operation, maintenance, tariff recovery, and regulatory oversight, areas where current arrangements remain fragmented.

### c. SDG 6.4 – Water-use efficiency and scarcity

Pakistan's water scarcity is intensified by low sectoral efficiency. The World Bank's national water security diagnostic finds that irrigation accounts for most withdrawals, with four major crops, rice, wheat, sugarcane, and cotton, consuming roughly 80% of water while contributing only about 5% to national GDP (World Bank, 2019). Canal seepage, outdated distribution infrastructure, and weak incentives for conservation limit water productivity relative to global benchmarks.

The NWP and National Adaptation Plan (NAP) propose improving irrigation efficiency, promoting on-farm water management, regulating groundwater abstraction, and incentivizing conservation technologies (GoP, 2018, 2023). Yet aquifer depletion trends in key agricultural regions, persistent canal conveyance losses, and limited adoption of high-efficiency irrigation technologies indicate that efficiency gains remain incremental rather than transformational.

SDG 6.4 therefore intersects with energy policy, agricultural subsidies, groundwater regulation, and pricing reforms. Without structural incentives for efficiency, including volumetric monitoring, crop pattern adjustments, and institutional strengthening, scarcity will continue to be managed through expansion rather than optimization.

#### **d. SDG 6.5 – Integrated Water Resources Management (IWRM)**

Integrated Water Resources Management (IWRM) is central to SDG 6.5 and is formally endorsed in the National Water Policy, which commits to basin-level planning, environmental flow protection, and cross-sector coordination (GoP, 2018). The National Climate Change Policy (NCCP) reinforces IWRM as an adaptation strategy, emphasizing rational allocation among competing sectors and groundwater protection (Ministry of Climate Change & Environmental Coordination, 2021).<sup>36</sup>

Despite this policy alignment, implementation remains constrained by institutional fragmentation. Water supply, irrigation, environment, and climate functions are distributed across federal and provincial bodies with limited basin-scale integration. Data gaps, inconsistent hydrological monitoring, and weak inter-provincial coordination hinder operational IWRM.

SDG 6 localization studies recommend provincial IWRM strategies, but these remain at early stages of institutionalization (UNDP, 2019). Pakistan's VNR reporting highlights institutional strengthening efforts; however, evidence of a fully operational, indicator-driven IWRM framework at river-basin scale remains limited. Progress toward SDG 6.5 requires functional integration, hydrometric modernization, transparent allocation data, and institutionalized multi-stakeholder coordination, not merely policy endorsement.

#### **e. SDG 6.6 – Ecosystems and water-related biodiversity**

Water-related ecosystems, including rivers, wetlands, and the Indus Delta, are explicitly recognized in both the National Water Policy and NCCP as requiring restoration and environmental flow protection (GoP, 2018; MoCC&EC, 2021). Concerns include seawater

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<sup>36</sup> Ministry of Climate Change and Environmental Coordination (MoCC&EC). (2021). *National Climate Change Policy (NCCP)*. Government of Pakistan. <https://mocc.gov.pk/SitelImage/Policy/NCCP%20Report.pdf>

intrusion in the delta, degraded wetlands, reduced downstream flows, and declining ecological integrity below major barrages.

However, SDG 6 and SDG 15 reporting indicates that time-series data on ecosystem condition remain incomplete, and freshwater systems continue to experience degradation from pollution, encroachment, and altered flow regimes (UNDP, 2019; GoP, 2022). The Sindh SDG 6 study notes deterioration in water quality within key ecosystems and calls for integrated watershed management and water-quality investments as dual climate adaptation and biodiversity protection strategies (UNDP, 2019).

The structural challenge lies in the absence of enforceable environmental flow regimes and ecological accounting within water allocation decisions. Ecological protection remains secondary to irrigation and municipal demands, particularly under scarcity conditions. Advancing SDG 6.6 requires embedding ecosystem metrics into allocation rules, developing consistent monitoring systems, and aligning restoration investment with basin-level planning.

## **4.2 Interlinked SDGs Enabled Through Water Stewardship**

Water stewardship is not confined to SDG 6 alone; rather, it operates as a systemic enabler across multiple SDGs by addressing the underlying governance, efficiency, equity, and resilience dimensions of water management. In Pakistan's context, where water insecurity intersects with public health, economic productivity, climate vulnerability, and ecological degradation, progress on water stewardship generates cross-sectoral development benefits.

### **a. Health and social equity (SDG 3 & SDG 5)**

Unsafe water supply, inadequate sanitation infrastructure, and poor wastewater management significantly contribute to the national burden of disease. Estimates indicate that tens of thousands of child deaths annually are linked to waterborne diseases and pollution-related health risks (World Bank, 2019; PILDAT, 2019). These outcomes directly impede SDG 3.3, which targets the reduction of communicable diseases, and SDG 3.9, which calls for reducing illness and mortality caused by unsafe water, sanitation, and environmental pollution (Government of Pakistan, 2019; PILDAT, 2019).

The relationship between water and health in Pakistan is not merely a service delivery issue but a structural equity challenge. Inconsistent supply, microbiological contamination, and inadequate sewage treatment disproportionately affect low-income communities, informal settlements, and rural populations. Weak institutional enforcement compounds exposure risks. Public health expenditures and productivity losses tied to water-related illnesses further reinforce poverty cycles.

Gendered impacts deepen this inequity. Mumtaz et al. (2025) argue that failures in SDG 6 implementation intensify vulnerabilities among women and children. In many rural and peri-urban settings, women bear primary responsibility for water collection, often under conditions of scarcity. Time spent fetching water reduces educational and income-generating opportunities and increases unpaid care burdens associated with caring for family members suffering from waterborne illnesses. Moreover, women remain underrepresented in formal water governance institutions, limiting inclusive decision-making processes (Mumtaz et al., 2025; Government of Pakistan, 2022).

Water stewardship offers a mechanism to address these inequities by embedding inclusive planning, community-based management structures, and gender-sensitive governance mechanisms into water initiatives. By prioritizing safe, reliable supply; ensuring accountability in service delivery; and increasing women's participation in water institutions, stewardship generates co-benefits for SDG 5.4 (recognizing unpaid care work) and SDG 5.5 (women's participation in leadership and decision-making) while strengthening SDG 3 outcomes.

#### **b. Economic and urban systems (SDG 8 & SDG 11)**

Water insecurity directly undermines economic productivity. The World Bank estimates that poor water management costs Pakistan approximately 4% of GDP annually due to inadequate domestic water supply, sanitation failures, flood and drought damages, and inefficient irrigation (World Bank, 2019). Irrigation inefficiencies constrain agricultural productivity, while unreliable urban supply increases operational costs for businesses and industrial sectors. These dynamics impede progress toward SDG 8.3 and SDG 8.5, which emphasize productive employment and sustained economic growth.

Water stewardship reforms, such as improving irrigation productivity, reducing non-revenue water, modernizing distribution systems, and enhancing wastewater reuse, have the potential to unlock substantial economic dividends. Efficient allocation reduces resource waste, increases agricultural returns per cubic meter of water, lowers business uncertainty, and supports stable employment conditions.

Urbanization intensifies these challenges. Rapid city expansion has outpaced upgrades in water supply networks, drainage systems, and sewage infrastructure. Urban flooding and environmental degradation, highlighted in SDG reporting under SDG 11.5 (disaster risk reduction) and SDG 11.6 (urban environmental quality), reflect systemic deficiencies in integrated water planning (Government of Pakistan, 2019, 2022; UNDP, 2019).

Urban water stewardship provides practical entry points: leakage reduction, integrated stormwater-wastewater planning, green infrastructure, aquifer recharge in peri-urban zones, transparent municipal performance monitoring, and participatory urban governance. These measures simultaneously enhance climate resilience, improve urban environmental conditions, and support economically vibrant, inclusive cities.

#### **c. Resource efficiency and climate resilience (SDG 12 & SDG 13)**

Water efficiency is central to sustainable production and consumption. SDG 12.2 and SDG 12.5 emphasize sustainable resource management and waste reduction, including wastewater reuse and water-efficient technologies. Pakistan's National Water Policy (NWP), National Climate Change Policy (NCCP), and National Adaptation Plan (NAP) identify efficient water use, reuse strategies, improved storage, and conservation as national priorities; however, implementation remains limited in scale and impact (Government of Pakistan, 2018, 2023; MoCC&EC, 2021).

Water systems are also foundational to climate adaptation. SDG 13.1 calls for strengthened resilience and adaptive capacity to climate hazards. In Pakistan, this translates into hydrologically appropriate storage expansion, groundwater regulation, demand management, infrastructure modernization, and diversification of water sources. SDG 13.3 emphasizes

institutional capacity-building and awareness, objectives directly referenced in the NAP's water-related measures (Government of Pakistan, 2023; World Bank, 2019).

By embedding water stewardship principles, efficiency, climate-informed planning, risk-based allocation, ecological safeguards, and transparency, into national climate frameworks, Pakistan can align SDG implementation with its NDC, BUR, and BTR processes. Rather than treating climate reporting and water management as parallel tracks, stewardship can integrate adaptation planning into operational water governance (UNFCCC, 2023; Government of Pakistan, 2024).<sup>37 38</sup> In this way, transparency and international reporting mechanisms have become drivers of domestic institutional reform.

#### **d. Ecosystems and biodiversity (SDG 15)**

Healthy freshwater ecosystems underpin fisheries, agriculture, and disaster resilience. Degradation of riverine systems, wetlands, and the Indus delta threatens SDG 15.1 and SDG 15.5, which focus on conserving terrestrial and inland freshwater ecosystems and halting biodiversity loss (Government of Pakistan, 2018; UNDP, 2019).

Reduced downstream flows, sea water intrusion in the Indus delta, pollution, and watershed degradation weaken ecological integrity and increase vulnerability to disasters. Both the NWP and NCCP explicitly prioritize restoring environmental flows, protecting watersheds, and addressing deltaic degradation as integral components of water security (Government of Pakistan, 2018; MoCC&EC, 2021).

Water stewardship reframes ecosystem protection not as a competing demand but as a foundational asset. Integrating environmental flow requirements into basin planning, promoting watershed restoration, conserving wetlands, and implementing floodplain management are examples of nature-based solutions that advance both SDG 6 and SDG 15. These strategies enhance biodiversity while simultaneously reducing disaster risk, improving water quality, and sustaining livelihoods.

### **4.3 Pakistan's reporting status**

Pakistan has progressively expanded its engagement with global reporting frameworks for both sustainable development and climate governance. The country presented its first Voluntary National Review (VNR) in 2019 and its second in 2022, outlining progress across SDG targets using national indicator data, SDG index scores, and sectoral performance assessments (Government of Pakistan, 2019, 2022). Both reviews identify water and sanitation as priority areas, acknowledging improvements in institutional coordination and statistical monitoring while highlighting persistent gaps in service delivery, quality assurance, and equity.

Institutionally, the Ministry of Planning established SDG Support Units at federal and provincial levels to coordinate monitoring and localization efforts. Official reporting indicates that data are now available for more than 130 national SDG indicators (MoPD&SI, 2021; Government of

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<sup>37</sup> UNFCCC. (2023). *Technical analysis of the first biennial update report of Pakistan (FCCC/SBI/ICA/2023/TASR.1/PAK)*. United Nations Framework Convention on Climate Change. [https://unfccc.int/sites/default/files/resource/tasr1\\_2023\\_PAK\\_0.pdf](https://unfccc.int/sites/default/files/resource/tasr1_2023_PAK_0.pdf)

<sup>38</sup> Government of Pakistan. (2024). *Pakistan Biennial Transparency Report (BTR1)*. Climate Laws. [https://climate-laws.org/document/pakistan-biennial-transparency-report-btr1\\_6b5d](https://climate-laws.org/document/pakistan-biennial-transparency-report-btr1_6b5d)

Pakistan, 2022).<sup>39</sup> This reflects meaningful progress in statistical system development and vertical policy alignment. However, concerns remain regarding data disaggregation, real-time monitoring, and the integration of environmental and water-related metrics across provinces. The availability of indicators does not yet guarantee their consistent operational use in budgeting, project design, and regulatory enforcement.

On the climate governance front, Pakistan submitted its second National Communication in 2019 and its first Biennial Update Report (BUR) in 2022. The BUR underwent technical analysis through the UNFCCC's International Consultation and Analysis (ICA) process (UNFCCC, 2023). The UNFCCC technical assessment acknowledged Pakistan's progress in emissions inventory preparation but noted that institutional arrangements for sustained reporting and comprehensive activity-data systems remain under development. Data gaps were identified in several sectors, including water-related waste management activities, signalling systemic coordination and capacity constraints (UNFCCC, 2023). These findings underscore that reporting improvements must be matched with stronger inter-agency data integration, especially for sectors such as wastewater and water resource management that intersect mitigation and adaptation domains.

Under the Paris Agreement's Enhanced Transparency Framework, Pakistan prepared and submitted its first Biennial Transparency Report (BTR1), accompanied by a 2024 emissions inventory, signalling a shift toward more regularized and standardized reporting cycles (GoP, 2024). This transition reflects increasing alignment with international transparency norms. Yet the effectiveness of transparency frameworks ultimately depends on whether reporting processes catalyse domestic policy reform rather than functioning as parallel compliance exercises.

The National Adaptation Plan (NAP), submitted to the UNFCCC, places the water-agriculture nexus, groundwater stress, and urban climate resilience at the centre of Pakistan's adaptation agenda (Government of Pakistan, 2023; GIZ, 2025).<sup>40</sup> Water is framed as a cross-sectoral risk amplifier, influencing food security, public health, infrastructure resilience, and ecosystem stability. However, financing pathways, sectoral investment plans, and detailed implementation arrangements, particularly at provincial and district scales, remain under operational development.

Civil society assessments of Pakistan's SDG reporting processes argue that, while policy alignment and institutional architecture have advanced significantly, measurable improvements in on-the-ground outcomes remain uneven and insufficient, especially for marginalized populations (A4SD, 2022).<sup>41</sup> This critique highlights a recurring structural gap: reporting systems are strengthening faster than implementation systems.

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<sup>39</sup> Government of Pakistan, Ministry of Planning, Development & Special Initiatives. (2021, November 18). Kick start of Voluntary National Review (VNR-2022) consultative meeting at Ministry of Planning, Development & Special Initiatives [Press release]. [https://pc.gov.pk/web/press/get\\_press/671](https://pc.gov.pk/web/press/get_press/671)

<sup>40</sup> Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). (2025). *Supporting the implementation of the National Adaptation Plan (NAP) in Pakistan* [Factsheet]. <https://www.giz.de/sites/default/files/media/pkb-document/2025-11/giz2025-en-factsheet-nap.pdf>

<sup>41</sup> Action for Sustainable Development (A4SD). (2022, July). *Spotlight report: Achieving SDGs in Pakistan – A long haul*. Action for Sustainable Development. <https://action4sd.org/wp-content/uploads/2022/10/CSOs-Spotlight-Report-2022.pdf>

Collectively, Pakistan's VNRs, BUR, BTR1, and NAP reflect a country deeply engaged in international sustainability and climate reporting frameworks. Institutional scaffolding for SDG monitoring and climate transparency has expanded. Nevertheless, persistent data gaps, coordination constraints, and financing limitations indicate that alignment between reporting commitments and domestic water resilience outcomes remains partial. The central challenge is not absence of reporting mechanisms, but ensuring that transparency exercises drive adaptive governance, regulatory reform, and basin-scale water stewardship in practice.

## 5. Domestic Water Resilience: Current Reality

Domestic water resilience in Pakistan must be understood not as a single-sector issue but as the outcome of interacting stresses: uneven access, inefficient allocation, aquifer depletion, climate volatility, and constrained local governance capacity. While national policies increasingly recognize these pressures, ground-level conditions reveal persistent fragility in both domestic water supply systems and broader hydrological management.

### 5.1 Urban-Rural Disparities in Water Access

National reporting under SDG 6 underscores stark disparities between urban and rural areas in both access to improved sources and the reliability and safety of supply (Government of Pakistan, 2019; PILDAT, 2019). Urban residents are more likely to have access to piped networks; however, intermittent supply, pressure fluctuations, and contamination within aging distribution systems frequently undermine water quality. As a result, even connected households often rely on tanker services or bottled water as coping mechanisms.

Access to Safely Managed Drinking Water and Basic Sanitation in Pakistan (2022)

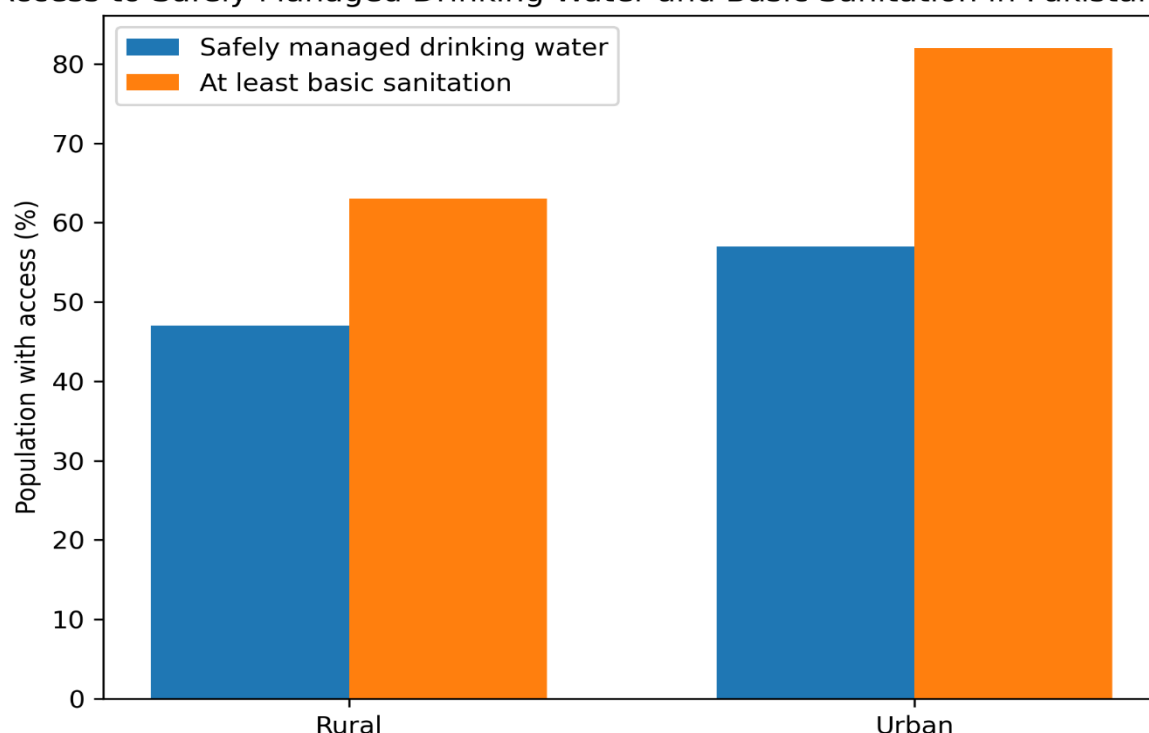


Figure 5: Access to safely managed drinking water and at least basic sanitation in rural and urban Pakistan (2022). While basic coverage is relatively high, safely managed services and sanitation access lag in rural areas.

Source: WHO/UNICEF JMP; World Bank GWSP synthesis<sup>424344</sup>

<sup>42</sup> <https://documents1.worldbank.org/curated/en/099146412192426111/pdf/IDU-b6b380f6-602d-4daa-a66f-424562f74354.pdf?utm>

<sup>43</sup> <https://www.worldbank.org/en/news/press-release/2019/02/04/pakistans-scarce-water-can-bring-more-value-to-people-and-economy?utm>

<sup>44</sup> <https://www.indexmundi.com/facts/pakistan/access-to-basic-drinking-water-services?utm>

Rural communities, by contrast, depend heavily on hand pumps, shallow wells, and surface sources, systems more vulnerable to microbial contamination, seasonal variability, and declining groundwater tables (PILDAT, 2019; UNDP, 2019). Rural sanitation coverage lags significantly behind urban rates, and poorly designed on-site sanitation systems, combined with shallow aquifers, contribute to groundwater contamination. In these settings, open defecation and unmanaged waste disposal further increase health risks (PILDAT, 2019).

The analytical implication is that national averages obscure localized pockets of acute water insecurity. SDG localization studies warn that without targeted rural investment, water-safety planning, and behaviour-change interventions, aggregated improvements will fail to reach vulnerable populations (UNDP, 2019; Mumtaz et al., 2025). Domestic resilience therefore varies not only by geography but by income, settlement type, and infrastructure design quality.

## 5.2 Agricultural Water Use Inefficiencies

Pakistan's domestic water security is intricately connected to basin-scale irrigation performance. The Indus Basin irrigation system, one of the largest in the world, faces significant conveyance losses, inequitable distribution, and low on-farm efficiency, resulting in poor water productivity relative to global benchmarks. The four dominant crops, rice, wheat, sugarcane, and cotton, consume roughly 80% of irrigation water while contributing only about 5% of GDP, indicating a structural misalignment between water use and economic return (World Bank, 2019).

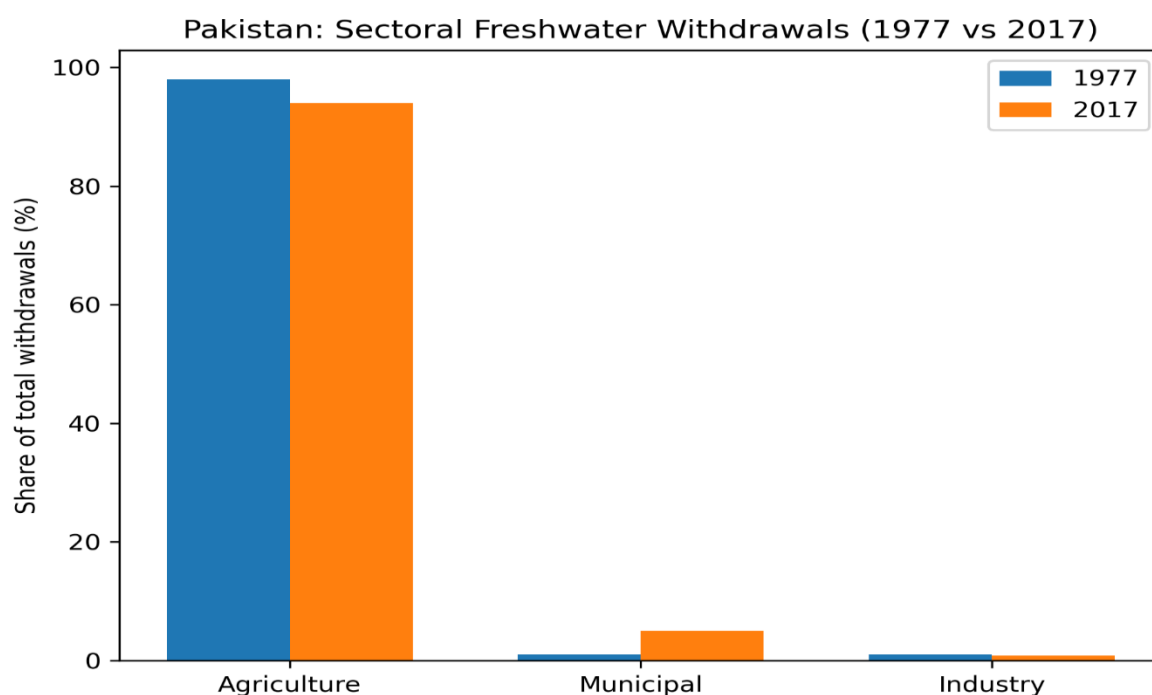


Figure 6: Sectoral freshwater withdrawals in Pakistan, 1977 vs 2017. Agriculture continues to dominate water use (98% → 94%), with only modest growth in municipal and industrial shares. Source: Siyal et al. (2023); World Bank<sup>454647</sup>

<sup>45</sup> <https://www.sciencedirect.com/science/article/pii/S2212371723000069?utm>

<sup>46</sup> <https://www.mdpi.com/2073-4441/12/2/477/htm?utm>

<sup>47</sup> <https://www.helgilibrary.com/indicators/freshwater-withdrawals-from-agriculture-as-of-total/pakistan/?utm>

National policies recognize this challenge. The National Water Policy identifies inefficient irrigation practices, weak cost recovery, and poor operation and maintenance as central constraints, recommending canal lining where justified, promotion of high-efficiency irrigation technologies, and reform of water pricing systems (Government of Pakistan, 2018). The National Adaptation Plan further emphasizes climate-smart agriculture and modernization of surface and groundwater irrigation services (Government of Pakistan, 2023).

However, these interventions remain insufficiently scaled. Basin-wide efficiency gains require not only technological improvements but institutional reforms, effective measurement of withdrawals, credible regulation of groundwater abstraction, and pricing signals that incentivize conservation. Without structural incentive adjustments, agricultural demand continues to dominate withdrawals, constraining domestic and ecological resilience.

### **5.3 Groundwater Depletion and Quality Degradation**

Groundwater now functions as an informal buffer for both households and farmers facing unreliable surface supply. Yet widespread, largely unregulated abstraction is depleting aquifers in major agricultural and urban zones, while water quality is increasingly compromised by salinity, industrial discharge, nitrates, and microbial contaminants (World Bank, 2019; PILDAT, 2019).

The National Water Policy acknowledges over-abstraction and calls for regulation and recharge measures, while the National Climate Change Policy proposes licensing, artificial recharge, and improved aquifer monitoring frameworks (MoCC&EC, 2021). Despite these provisions, most provinces lack robust groundwater governance systems equipped with metering, licensing, and enforcement authority. Large numbers of private tube-wells operate without oversight, exacerbating depletion trends (World Bank, 2019; Mumtaz et al., 2025).

The analytical consequence is a classic common-pool resource dilemma: groundwater extraction decisions are made individually, but impacts are shared collectively. Rural and peri-urban communities often face a double burden, declining water tables that increase pumping costs and deteriorating quality that raises health risks, thereby weakening domestic resilience.

### **5.4 Flood-Drought Paradox and Infrastructure Stress**

Pakistan's climate trajectory illustrates a pronounced flood-drought paradox. Severe riverine and flash floods, alternating with droughts and heatwaves, reflect the intensification of hydrological extremes under climate change (Government of Pakistan, 2023; MoCC&EC, 2021). The National Climate Change Policy highlights glacial lake outburst floods, intensified monsoon rainfall, and rising evapotranspiration as major threats that complicate reservoir management and stress dams, barrages, canals, and flood protection systems.

The National Adaptation Plan and disaster-management strategies call for expanded storage capacity, rehabilitation of aging infrastructure, integrated floodplain management, and improved forecasting (Government of Pakistan, 2023). Yet current investment levels and inter-agency coordination fall short of the scale required to manage systemic climate volatility.

Urban infrastructure faces additional stress. Encroachment on natural waterways, inadequate drainage, and poorly designed stormwater systems heighten flood vulnerability and contribute to contamination during high-flow events (Government of Pakistan, 2022; UNDP, 2019). The

result is a reinforcing cycle: flood events degrade water quality, which increases health risks and service disruption, further weakening resilience.

### **5.5 Institutional Capacity Constraints at District Level**

A recurring constraint across domestic water systems is limited implementation capacity at district and municipal levels. Although federal and provincial institutions have strengthened SDG and climate reporting functions, local entities responsible for delivering water services often lack sufficient technical expertise, financial resources, and integrated data systems (A4SD, 2022).

Institutional fragmentation, inadequate financing, and weak coordination between government tiers reduce the effectiveness of otherwise sound policy frameworks (Mumtaz et al., 2025). Civil-society assessments of the VNR process note that many local governments remain insufficiently integrated into SDG planning and monitoring processes, limiting accountability and reducing community participation in water governance (A4SD, 2022).

From a resilience perspective, this is critical: domestic water security is delivered locally. Where municipal utilities or district administrations lack operational autonomy, stable funding, and performance oversight, national commitments cannot translate into service-level improvements. The gap between policy formulation and household-level outcomes therefore remains substantial.

## 6. Structural Constraints in Advancing Water-Related SDGs

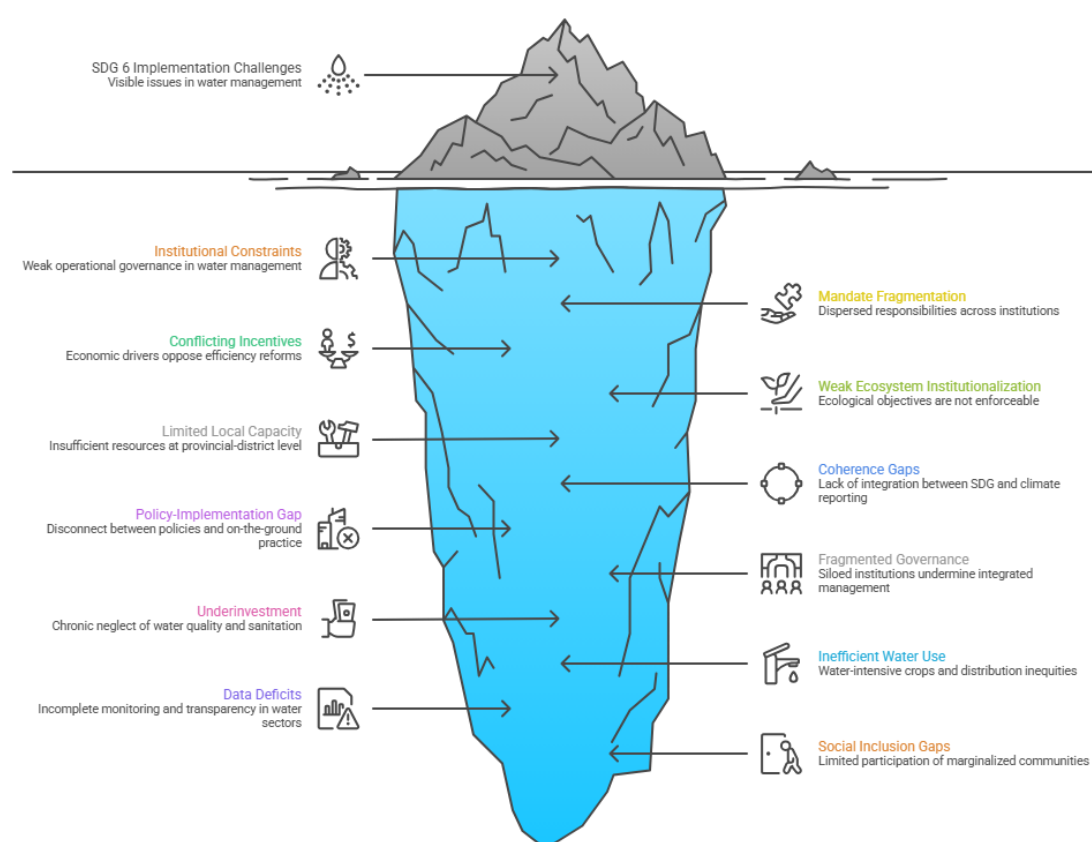


Figure 7: Structural constraints hindering water related SDGs in Pakistan.

Source: Author's own analysis

### 6.1 Institutional Constraints in SDG 6 Implementation

Pakistan's SDG framework, particularly SDG 6, shows that the country has formal commitments, policies, and reporting structures, but weaker operational governance to translate those commitments into reliable outcomes. When SDG 6.1–6.6 is read alongside the interlinked SDGs (health, equity, growth, cities, climate, ecosystems), a set of recurring governance failures appears. These are not isolated project-level problems; they are structural mismatches between how water is governed and what SDG delivery requires.

#### 1) Coverage has improved faster than quality assurance and regulatory control (SDG 6.1, 6.3).

Pakistan's reporting acknowledges investment in water schemes and filtration plants, yet persistent contamination and poor wastewater management indicate that "access" gains often do not translate into "safe, reliable service" outcomes (Government of Pakistan, 2019, 2022; PILDAT, 2019). This reflects a governance gap: water supply is frequently treated as a construction problem rather than a regulated public service. Intermittent supply, limited source protection, and weak enforcement of drinking-water standards increase contamination risks, while near-absence of municipal wastewater treatment indicates limited municipal capacity and

underdeveloped compliance systems (PILDAT, 2019; World Bank, 2019). In governance terms, the accountability chain is broken: monitoring exists, but enforcement and sustained operations do not reliably follow.

## **2) Mandates are fragmented across institutions and levels, weakening basin-scale decision-making (SDG 6.5).**

IWRM is formally endorsed in national policy, but functional integration remains limited due to dispersed responsibilities across federal and provincial departments and uneven capacity at local levels (GoP, 2018; UNDP & Government of Sindh, 2019). Coordination challenges are not just administrative; they are structural because Pakistan's water system is hydrologically integrated (Indus Basin) while governance remains largely jurisdiction based. The result is predictable: cross-sector planning (water–agriculture–environment–climate) is difficult, data systems are inconsistent, and decisions often remain reactive rather than risk-informed (World Bank, 2019). In practice, IWRM becomes aspirational language rather than an operating system.

## **3) Incentives and political economy often conflict with efficiency reforms (SDG 6.4).**

Pakistan's efficiency challenge is not simply a lack of technology; it is an incentive structure problem. Policies promote irrigation efficiency, groundwater regulation, and conservation, yet actual practice shows continued aquifer stress, canal losses, and limited adoption of high-efficiency irrigation (GoP, 2018, 2023; World Bank, 2019). This reflects weak alignment between SDG 6.4 objectives and the underlying drivers of water use: crop choices, pricing signals, and institutional arrangements. Without credible measurement (volumetric monitoring), enforceable groundwater governance, and reforms that make efficiency economically rational, efficiency remains a pilot-program outcome rather than a system-wide transition.

## **4) Environmental flows and ecosystem protection are recognized but weakly institutionalized (SDG 6.6).**

National policies acknowledge ecosystem degradation and the need for restoration and environmental flow protection (GoP, 2018; MoCC&EC, 2021). However, SDG reporting highlights sparse time-series ecosystem data and ongoing deterioration from reduced flows, pollution, and encroachment (UNDP, 2019; GoP, 2022). The core governance gap is that ecological objectives are rarely embedded as enforceable constraints in allocation and infrastructure operation rules. Ecosystems become "considerations" rather than "requirements," especially under scarcity conditions when agriculture and municipal demand dominate allocation choices. Put bluntly: ecosystems are governed as residuals.

## **5) Local implementation capacity is a binding constraint across SDG targets.**

Across drinking-water safety, wastewater regulation, urban resilience, and ecosystem management, Pakistan's operational bottleneck repeatedly appears at the provincial-district interface. Where staffing, budgets, technical capacity, and coordination are limited, SDG targets become compliance narratives rather than delivery realities (Government of Pakistan, 2019, 2022). This is why outcomes remain uneven across provinces and between urban–rural contexts, even when national policies are well-written. In governance terms: policy exists at the top, impacts are needed at the bottom, and the connective tissue is weak.

## 6.2 Institutional Coherence Across SDG and Climate Transparency Mechanisms

Pakistan has made visible progress in sustainability and climate reporting: VNRs (2019, 2022), expanded SDG indicator systems, the BUR process and UNFCCC technical analysis, the BTR1 under the Enhanced Transparency Framework, and the NAP's prioritization of the water-agriculture nexus (Government of Pakistan, 2019, 2022; UNFCCC, 2023; Government of Pakistan, 2023a; GoP, 2024). The analytical question is whether these instruments are coherent with one another and whether they produce implementation traction, or whether they operate as parallel reporting tracks.

A good way to structure this “coherence assessment” is to evaluate three layers:

- **Indicator coherence** (Are we measuring compatible things?)
- **Institutional coherence** (Are the same agencies able to act across frameworks?)
- **Investment coherence** (Do plans link to financing and enforceable implementation?)

### **1) Indicator coherence: SDG metrics and climate transparency still do not fully meet in the middle.**

The VNRs use SDG indicators and sectoral narratives to track progress (Government of Pakistan, 2019, 2022). Climate transparency reporting (BUR/BTR) focuses on emissions inventories and adaptation/mitigation information, with technical analysis noting ongoing development of institutional arrangements and data systems, plus gaps in activity data including in water-linked sectors such as waste (UNFCCC, 2023). This produces a coherence challenge: SDG 6 reporting is outcome-oriented (safe water, wastewater treatment, efficiency), while climate transparency is often inventory- and process-oriented. Without deliberate integration, the same water sector can be “measured” in two different languages, limiting the ability to use reporting as a management tool.

### **2) Institutional coherence: SDG and climate reporting structures are strengthening, but operational delivery structures lag.**

Pakistan reports SDG Support Units at federal and provincial levels and availability of data for 130+ indicators (MoPD&SI, 2021; Government of Pakistan, 2022). That is significant institutional scaffolding. Yet UNFCCC technical assessment highlights that continuous reporting arrangements and comprehensive activity-data systems are still under development (UNFCCC, 2023). The deeper issue: reporting units can compile and submit documents even when service delivery agencies cannot consistently enforce standards, operate treatment plants, or regulate abstraction. This creates the common “reporting vs. results” gap: the country becomes better at describing problems than solving them at scale.

### **3) Investment coherence: plans identify priorities, but financing pipelines and implementation mechanisms are still incomplete.**

The NAP centers water-agriculture and urban resilience and frames water as a cross-sectoral risk amplifier (Government of Pakistan, 2023a). Yet operationalization, financing pathways, sector investment plans, and local implementation arrangements, remains under development (Government of Pakistan, 2023; GIZ, 2025). This is the critical hinge: reporting and planning become transformative only when they generate fundable project pipelines, enforceable regulations, and measurable improvements at basin and city scales. Civil society assessments

echo this, arguing that despite stronger alignment and institutions, outcomes remain uneven and too slow, particularly for marginalized populations (AWS, 2014).<sup>48</sup> That diagnosis is basically a coherence verdict: strategic alignment is improving, delivery alignment is not keeping pace.

Where water stewardship fits in this coherence problem:

Water stewardship can be positioned as the “integration layer” that converts reporting into delivery by doing three things:

- **Aligning metrics:** linking SDG 6 indicators (quality, service continuity, wastewater treatment) with climate adaptation indicators and BTR reporting needs, so the same monitoring system serves both agendas (UNFCCC, 2023; Government of Pakistan, 2024).
- **Aligning institutions:** creating basin- and city-level multi-stakeholder platforms that connect SDG Support Units, climate planning bodies, regulators, utilities, and communities into an operational coordination mechanism.
- **Aligning investments:** turning NAP priorities into stewarded project pipelines, wastewater treatment + reuse, leakage reduction, aquifer management, ecosystem restoration, that can be financed, monitored, and reported under both SDG and UNFCCC frameworks (Government of Pakistan, 2023a; GIZ, 2025).

### 6.3 Key Gaps Between SDGs and Domestic Practice

Despite strong policy articulation and international reporting engagement, Pakistan’s domestic water outcomes reveal persistent gaps between SDG commitments and on-the-ground practice. These gaps are not confined to isolated sectors; rather, they reflect systemic weaknesses in governance integration, investment priorities, institutional coordination, and accountability. The following dimensions illustrate where alignment between SDG targets and domestic water realities remains incomplete.

#### 1) Policy–Implementation Gap and Weak Vertical Integration

Pakistan has developed a comprehensive portfolio of water- and climate-related policies, including the National Water Policy (NWP), National Climate Change Policy (NCCP), National Adaptation Plan (NAP), and SDG-aligned sector strategies, that broadly align with SDG 6 and related targets. However, progress in policy formulation has not been matched by proportional shifts in budgeting, institutional restructuring, or regulatory enforcement. Critical provisions such as groundwater regulation, environmental flow protection, wastewater treatment expansion, and climate-risk screening of water investments remain partially implemented, pilot-based, or uneven across provinces and districts (World Bank, 2019; Mumtaz et al., 2025).

Vertical integration, the translation of federal frameworks into provincial planning and district execution, remains weak. SDG-aligned targets articulated in Voluntary National Reviews (VNRs) often lack detailed local roadmaps, financing strategies, or enforceable accountability mechanisms. As a result, global commitments are frequently decoupled from operational planning, and resilience outcomes vary considerably by region. The structural issue is not

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<sup>48</sup> Alliance for Water Stewardship. (2014, April 8). *The AWS international water stewardship standard* (Version 1.0). Alliance for Water Stewardship.

absence of strategy, but limited alignment between planning tiers and limited institutional continuity from policy design to field-level delivery.

## **2) Fragmented Governance and Siloed Institutions**

Water governance in Pakistan spans multiple ministries and departments, including water resources, irrigation, agriculture, local government, health, environment, and climate change, each operating within distinct mandates and data systems. Although the NWP recognizes water as a national resource and calls for integrated management, it does not fully resolve jurisdictional overlaps or create a single empowered entity with authority to coordinate basin-scale planning across provinces and sectors (Government of Pakistan, 2018; World Bank, 2019).

This fragmentation extends to sub-national levels. Municipal utilities, irrigation departments, and public health authorities frequently operate without integrated planning. Wastewater discharge may contaminate drinking-water sources, irrigation schedules may neglect downstream domestic needs, and environmental flows may remain secondary to sectoral allocation priorities (PILDAT, 2019; Mumtaz et al., 2025). Institutional misalignment thus directly undermines operationalization of SDG 6.5 (IWRM) and 6.6 (ecosystem protection). The result is a governance structure where hydrological interdependence is managed through administrative silos.

## **3) Chronic Underinvestment in Water Quality, Sanitation, and Wastewater**

Although SDG 6 and national policy frameworks emphasize water quality, sanitation, and wastewater treatment, these areas remain chronically underfunded relative to large-scale irrigation and storage projects (PILDAT, 2019; World Bank, 2019). The fact that less than 1% of wastewater is treated and that 69–85% of sampled water sources are contaminated reflects systemic neglect of pollution control, treatment infrastructure, and operational maintenance (PILDAT, 2019; World Bank, 2019).

Sanitation and hygiene programs are frequently implemented as short-term, project-based interventions rather than sustained service systems. Once donor funding concludes, gains often erode. Tariff structures and cost-recovery systems are rarely designed to support full life-cycle management of wastewater treatment facilities, leading to operational decline even where infrastructure exists. This persistent underinvestment constrains progress under SDG 6.1, 6.2, and 6.3 and contributes to elevated disease burdens that impede SDG 3 targets related to communicable diseases and environmental health.

## **4) Inefficient and Inequitable Agricultural Water Use**

Despite formal commitments to water-use efficiency under SDG 6.4, irrigation systems continue to favour water-intensive cropping patterns supported by low water tariffs and limited conservation incentives (Government of Pakistan, 2018; World Bank, 2019). The dominance of four water-intensive crops, using roughly 80% of irrigation water while contributing comparatively modest economic returns, illustrates the disconnect between efficiency goals and actual allocation patterns (Government of Pakistan, 2018; World Bank, 2019).

Distribution inequities further compound inefficiency. Head-end farmers often receive more reliable canal supplies than tail-end users, while unregulated groundwater pumping exacerbates both inequities and aquifer depletion (World Bank, 2019; Mumtaz et al., 2025). These outcomes

conflict with SDG principles of equity and “leaving no one behind.” Technical reforms, such as high-efficiency irrigation technologies, will remain limited in impact unless paired with governance reforms that include transparent allocation rules, strengthened farmer organizations, equitable cost-sharing mechanisms, and gender-inclusive water user associations.

## **5) Data, Monitoring, and Transparency Deficits**

While Pakistan has strengthened SDG indicator availability and engaged actively in climate reporting through BUR and BTR submissions, significant data gaps persist in water-related sectors. Groundwater levels, water quality, non-revenue water in municipal systems, wastewater generation and treatment volumes, and ecosystem health indicators remain incompletely monitored or inconsistently reported. The technical analysis of Pakistan’s first BUR highlighted incomplete activity data and emphasized the need for more robust institutional arrangements for continuous reporting under the enhanced transparency framework (UNFCCC, 2023).

At the domestic level, many utilities and irrigation departments lack integrated management information systems, and SDG indicators are not fully embedded in routine operational performance monitoring. Without reliable, real-time data, planning cannot be evidence-driven, and accountability remains weak. The feedback loop between international commitments and domestic implementation remains underdeveloped.

## **6) Social Inclusion, Gender, and Community Engagement Gaps**

Despite recognition that women, children, and marginalized communities bear disproportionate burdens from water insecurity, their participation in formal water governance institutions remains limited (Mumtaz et al., 2025). Many water projects frame communities as beneficiaries rather than partners in design, monitoring, and adaptive management, which reduces ownership and long-term sustainability.

This gap undermines progress not only under SDG 6 but also SDG 5 and SDG 10. Excluding local users from decision-making diminishes contextual fit, reduces compliance incentives, and limits opportunities for community-led monitoring and co-financing arrangements. Without deeper inclusion, water stewardship efforts risk replicating top-down models that fail to address local priorities or mobilize local knowledge.

## 7. Private Sector Engagement for Water Stewardship in Pakistan

The *Nestlé Water Stewardship Project* focused on promoting responsible and sustainable water use across agricultural and industrial sectors in Pakistan through a collaborative partnership with the Sustainable Development Policy Institute. The initiative addressed growing challenges related to water scarcity, inefficient irrigation practices, and weak governance mechanisms by combining research, policy advocacy, and multi-stakeholder engagement. Key activities included organizing advocacy dialogues on water stewardship, conducting research on irrigation efficiency and groundwater management, and developing policy briefs highlighting the role of the private sector in strengthening water governance. The project emphasized the importance of integrating corporate water stewardship into national water policies while encouraging industries to adopt responsible practices such as water-use efficiency, improved wastewater management, and transparent reporting on water withdrawals and quality impacts. By engaging policymakers, industry representatives, and civil society actors, the initiative helped raise awareness about shared responsibility in water management and promoted collaboration between public institutions, private companies, and research organizations to advance sustainable water governance and scale water stewardship practices across sectors.

The *PepsiCo Water Stewardship Project* implemented in Chak RS, Shujabad addressed multiple water-related challenges including water insecurity, poor sanitation, waterborne diseases, and environmental degradation in rural communities through an integrated and community-centered approach. The initiative combined technological interventions with local governance mechanisms to improve water access, quality, and sustainability, including solar-powered water filtration systems for safe drinking water, floating treatment wetlands for wastewater treatment and ecosystem restoration, rainwater harvesting systems for groundwater recharge, and ablution water reuse systems to encourage water conservation. Alongside these infrastructure interventions, the project conducted community awareness campaigns focusing on hygiene, sanitation, and responsible water use to promote long-term behavioral change and community ownership. These interventions significantly improved access to safe drinking water for the majority of households, reduced health risks associated with contaminated water sources, and strengthened agricultural resilience by improving water availability. The project also reduced the time women and children spent collecting water, enabling greater participation in education and livelihood activities, while the use of nature-based solutions and groundwater recharge systems contributed to environmental sustainability and demonstrated a scalable model for community-based water stewardship in rural Pakistan.

A comparison of the two initiatives highlights complementary approaches to strengthening water stewardship and governance in Pakistan. The Nestlé initiative primarily focused on policy advocacy, research, and institutional engagement, aiming to influence water governance frameworks and promote responsible water management practices within industry and agriculture. In contrast, the PepsiCo project emphasized practical, community-level interventions that directly improved water access, sanitation, and environmental conditions through technological solutions and nature-based systems. While the Nestlé partnership with the Sustainable Development Policy Institute contributed to shaping policy dialogue and

encouraging corporate accountability, the PepsiCo initiative demonstrated how water stewardship principles can be translated into tangible local outcomes that improve public health, agricultural resilience, and environmental sustainability. Together, these cases illustrate how combining policy-level engagement with grassroots implementation can create a more comprehensive pathway for strengthening water governance, bridging the gap between national policy frameworks and local water management practices.

## 8. Water Stewardship as a Bridging Framework

Pakistan's water challenge is not primarily a shortage of policy language; it is a shortage of integrated, accountable implementation mechanisms. Water stewardship offers a bridging framework that connects national SDG commitments with basin-level realities and local institutional practice.

A Pakistan-relevant definition must adapt global standards to domestic governance conditions. In line with international frameworks, water stewardship can be defined as the responsible, transparent, and collectively governed use and protection of water resources, socially equitable, environmentally sustainable, and economically beneficial, implemented through site-based actions and catchment or aquifer-level collective action with shared metrics and accountability (AWS, 2014; Julio et al., 2021).<sup>49</sup>

This definition is significant for Pakistan because it introduces a logic currently underdeveloped in the system: shared hydrological outcomes with co-accountability. Instead of fragmented agency mandates and project-by-project interventions, stewardship emphasizes basin- or aquifer-scale metrics, cross-sector coordination, and measurable compliance. It reframes water from an administratively divided resource into a collectively governed system requiring shared responsibility.

### 8.1 Operationalizing SDG 6 Through Stewardship

Water stewardship can function as an implementation bridge for SDG 6 by aligning actors around measurable targets (*Figure 8*) at the scale where water is managed, river basins, canal commands, aquifers, municipal service areas.

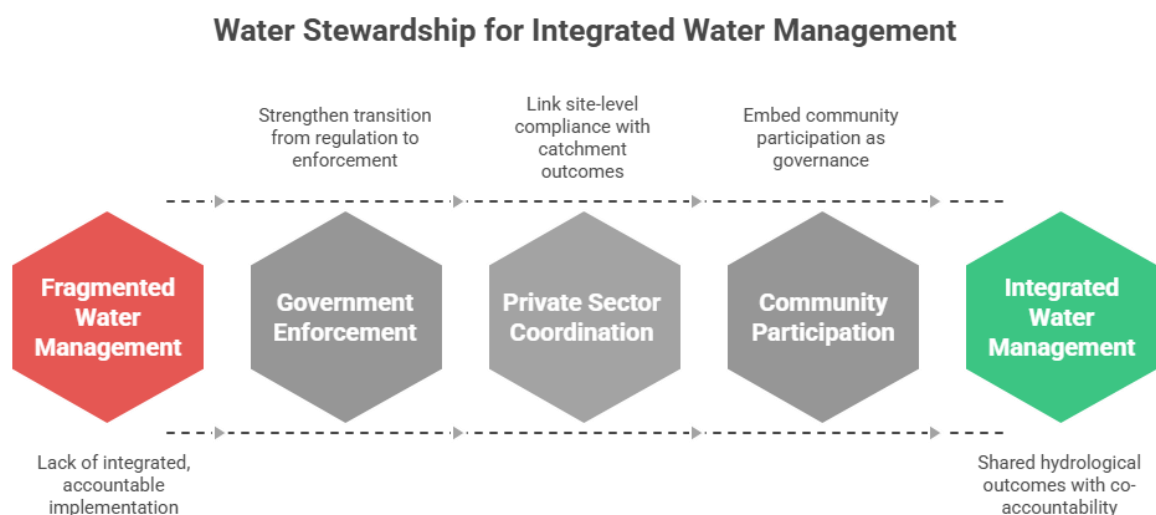


Figure 8: Water Stewardship for Integrated Water Management

Source: Author's own analysis

<sup>49</sup> Julio, N., Figueroa, R., & Ponce Oliva, R. D. (2021). Water resources and governance approaches: insights for achieving water security. *Water*, 13(21), 3063.

## **a. Government**

Government remains indispensable for defining abstraction limits, discharge standards, environmental flow thresholds, water-quality norms, and tariff regimes. However, Pakistan's governance gaps often lie in the transition from regulation to enforcement. Stewardship approaches can strengthen this transition by embedding monitoring, reporting, and verification (MRV) systems within basin-level or aquifer-level platforms.

Rather than relying solely on statutory rules, stewardship frameworks integrate shared data platforms, transparent water accounting, public disclosure mechanisms, and multi-stakeholder review processes. This shifts emphasis from formal compliance declarations toward measurable, continuously monitored performance outcomes.

In practical terms, stewardship could institutionalize water budgeting at district or basin level, link groundwater licensing to metered extraction data, and align wastewater discharge monitoring with SDG 6.3 indicators. Such integration directly addresses the implementation and data deficits identified in Pakistan's reporting processes.

## **b. Private Sector**

Industry and commercial agriculture are central to water demand pressures. Corporate actors can reduce water stress through water-use efficiency, wastewater treatment and reuse, pollution control, and transparent public reporting. However, governance research cautions that corporate water initiatives can produce localized improvements without addressing broader basin inequities unless embedded within inclusive governance frameworks (Sojamo & Rudebeck, 2024).<sup>50</sup>

In Pakistan, case evidence from water-intensive sectors such as textile processing demonstrates that water recycling, cleaner production methods, and effluent treatment are technically feasible when regulatory signals and economic incentives align (Naqvi et al., 2018; Abbas et al., 2020).<sup>51 52</sup> Yet isolated corporate efforts do not substitute for basin-level coordination.

Stewardship reconciles these dimensions by linking site-level industrial compliance with catchment-scale outcomes. Private actors become co-responsible stakeholders within shared aquifer or watershed plans. Transparent disclosure, alignment with SDG indicators, and integration into provincial water strategies transform corporate water management from reputational risk mitigation into a component of collective water security.

## **c. Communities and Local Institutions**

Groundwater systems and canal commands function as common-pool resources. International governance scholarship emphasizes that successful collective management requires clearly defined boundaries, monitoring arrangements, graduated sanctions, and trusted institutions.

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<sup>50</sup> Sojamo, S., & Rudebeck, T. (2024). Corporate Engagement in Water Policy and Governance: A Literature Review on Water Stewardship and Water Security. *Water Altern. Interdiscip. J. Water Politics Dev*, 17, 292-324.

<sup>51</sup> Naqvi, S. A., Arshad, M., Farooq, A., & Nadeem, F. (2019). Implementation of sustainable practices in textile processing mills of Lahore, Pakistan. *Polish Journal of Environmental Studies*, 29(1), 1-9.

<sup>52</sup> Abbas, S., Hsieh, L. H. C., Techato, K., & Taweekun, J. (2020). Sustainable production using a resource-energy-water nexus for the Pakistani textile industry. *Journal of Cleaner Production*, 271, 122633.

These design principles are highly relevant to Pakistan’s rural irrigation associations, peri-urban groundwater zones, and local water committees.

Water stewardship embeds community participation not as consultation but as governance. Participatory water budgeting, community-level monitoring of quality indicators, gender-inclusive water user associations, and locally negotiated allocation rules enhance social legitimacy and compliance.

In many Pakistani contexts, especially rural and peri-urban areas facing aquifer depletion, sustainable management is infeasible without local engagement. Stewardship frameworks provide structured mechanisms for trust-building, dispute resolution, and transparency, critical elements currently underdeveloped in district-level water governance.

*Table 1: Roles of different stakeholders in operationalizing water stewardship in Pakistan*

| Actor                                                         | Core Responsibilities Under Stewardship                                                                                                                                                                                  | SDG Linkages                     | Accountability & Metrics                                                                                                                                  |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Federal Government</b>                                     | Set national standards for abstraction, discharge, water quality, and environmental flows; coordinate basin-level planning; align SDG and climate reporting (NDC, BUR, BTR); create financial and regulatory incentives. | SDG 6.3, 6.4, 6.5, 6.6; SDG 13.1 | National water budgets; groundwater licensing systems; discharge compliance rates; integration of SDG indicators into BTR reporting.                      |
| <b>Provincial Governments</b>                                 | Implement NWP and NAP provisions; regulate groundwater and irrigation; oversee utilities; enforce environmental standards; integrate climate-risk screening into water investments.                                      | SDG 6.1–6.6; SDG 2.4; SDG 11.5   | Provincial water accounts; % wastewater treated; irrigation efficiency indicators; groundwater level monitoring; climate-risk-screened project approvals. |
| <b>District / Municipal Authorities</b>                       | Deliver domestic water supply and sanitation services; maintain local infrastructure; ensure water-quality testing; manage urban drainage; coordinate local watershed management.                                        | SDG 6.1, 6.2, 6.3; SDG 11.5      | Non-revenue water rates; continuity of supply; microbial compliance rates; stormwater performance benchmarks.                                             |
| <b>Private Sector (Industry &amp; Commercial Agriculture)</b> | Improve water-use efficiency; treat and reuse wastewater; disclose water footprints; participate in basin/aquifer platforms; co-finance conservation initiatives.                                                        | SDG 6.3, 6.4; SDG 8.3; SDG 12.2  | Site-level water productivity metrics; effluent quality compliance; % wastewater reused; alignment with basin-level targets.                              |
| <b>Farmers &amp; Water User Associations</b>                  | Adopt efficient irrigation; participate in equitable water allocation; support groundwater monitoring;                                                                                                                   | SDG 6.4; SDG 2.4; SDG 10         | Canal distribution transparency; volumetric pilot schemes; crop-water productivity ratios.                                                                |

|                                                      |                                                                                                                                                          |                                      |                                                                                                        |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------|
|                                                      | engage in crop diversification and demand management.                                                                                                    |                                      |                                                                                                        |
| <b>Communities &amp; Civil Society</b>               | Participate in planning, oversight, and monitoring; support behaviour change; ensure gender inclusion; monitor local water quality and ecosystem health. | SDG 3.3, 5.4, 5.5; SDG 6.b; SDG 16.6 | Community water-safety plans; participatory monitoring reports; gender representation in water bodies. |
| <b>Development Partners / Climate Finance Actors</b> | Provide technical assistance, finance adaptation investments, strengthen monitoring systems, and support capacity-building for stewardship platforms.    | SDG 6, 13, 15                        | Climate-adaptation finance tracked against measurable basin-level resilience indicators.               |

### Synergies with Pakistan's Adaptation Planning

Pakistan's National Adaptation Plan (NAP) places water and agriculture at the core of its adaptation strategy, recognizing the crucial link between water security, agricultural resilience, and climate adaptation (Government of Pakistan, 2023). The NAP identifies key priorities such as groundwater stress, irrigation modernization, urban resilience, watershed management, and climate-informed planning. However, the effectiveness of these broad national objectives hinges on the ability to translate them into actionable local plans, particularly in vulnerable regions like Khyber Pakhtunkhwa (KP) and Balochistan, where adaptation needs vary based on distinct regional risks.

Water stewardship strengthens NAP implementation by providing the operational tools to convert broad goals into measurable outputs. For instance, stewardship frameworks integrate specific actions such as basin water budgets, aquifer recharge targets, wastewater-treatment benchmarks, environmental flow allocations, and efficiency indicators, each of which can be tracked, audited, financed, and scaled at local levels. These metrics help ensure that adaptation measures are not abstract targets but practical, enforceable actions that directly contribute to improved water management and climate resilience at community and district levels.

Moreover, stewardship frameworks align adaptation finance with accountability structures, ensuring that climate investments generate long-term improvements, not just one-off infrastructure projects. For example, projects designed to improve irrigation efficiency or restore watersheds can be directly linked to financing mechanisms that include clear performance metrics, regular audits, and community oversight. This creates a transparent system where funds are allocated based on measurable impacts, fostering trust among stakeholders.

By integrating water stewardship into District Adaptation Plans (DAPs), currently under development by Sustainable Development Policy Institute (SDPI)<sup>53</sup> for districts like Charssadda and Karak, this framework can ensure that localized adaptation strategies are directly aligned with national priorities. The DAPs, which are being created to enhance climate resilience,

<sup>53</sup> [https://sdpi.org/building-capacity-to-advance-national-adaptation-plan-process-in-pakistan-nap-project/project\\_detail](https://sdpi.org/building-capacity-to-advance-national-adaptation-plan-process-in-pakistan-nap-project/project_detail)

provide an ideal entry point for embedding water stewardship principles into local water governance systems, particularly for areas facing distinct challenges such as groundwater depletion in KP or water scarcity in Balochistan.

Furthermore, linking stewardship metrics to SDG reporting and transparency systems allows climate governance instruments, such as Pakistan's BTRs and VNRs, to reinforce domestic institutional reform rather than existing in parallel as compliance exercises. Stewardship, therefore, helps ensure that climate adaptation is not a one-time effort but a continuous, adaptive process that aligns with global reporting frameworks while delivering local impact.

Ultimately, water stewardship functions as a governance integrator. It addresses the disconnect between policy ambition and operational delivery by embedding accountability, shared metrics, and inclusive participation at the scales where hydrological decisions are made, whether at the river basin, aquifer, or district level. In Pakistan's context, characterized by fragmented mandates, groundwater stress, agricultural dominance, climate volatility, and institutional capacity constraints, stewardship offers an institutional architecture that aligns SDG 6 targets, climate adaptation priorities, and domestic resilience objectives into a coherent, accountable system. By fostering cross-sectoral coordination, data sharing, and collaborative governance, stewardship helps ensure that adaptation actions are not just policy aspirations but tangible improvements in local water resilience.

## 9. Policy Recommendations

These recommendations are drawn directly from the evidence and analytical gaps identified in earlier sections of this policy brief. They are designed to address Pakistan's systemic water governance challenges, including policy implementation gaps, siloed institutions, weak data and enforcement regimes, underinvestment in water quality and wastewater systems, and limited private-sector engagement, while leveraging emerging models of water stewardship from both public-private and community-centred initiatives (e.g., Nestlé Pakistan-SDPI collaboration and the PepsiCo Chak RS project). Each recommendation specifies *who* should take action, *what* should be done, and *why* it matters for advancing SDG 6 and water resilience.

| Time Frame                        | Recommendation                                            | Who                                                                                                | What                                                                                                                                  | Why                                                                                                                                                                                          |
|-----------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short-term<br/>(1-2 years)</b> | Pilot Stewardship-Integrated DAPs in Vulnerable Districts | Provincial Planning & Development Departments; NDMA; MoCC; Local Governments; NAP Team             | Operationalize Charssadda & Karak District Adaptation Plans with water stewardship metrics (e.g., water budgets, quality targets).    | Aligns local adaptation planning with SDG 6 operationalization and the brief's finding that local capacity constraints impede SDG outcomes.                                                  |
|                                   | Activate Inter-Agency Water Stewardship Task Forces       | Ministry of Water Resources; MoCC; PCRWR; IRSA; Provincial Water Forums                            | Establish cross-sector task forces to coordinate SDG 6, climate transparency, groundwater regulation, and urban/rural water planning. | Responds to fragmented governance: "siloed institutions" weaken SDG implementation. Task forces will improve coherence and eliminate duplicate reporting efforts.                            |
|                                   | Establish Industrial Water Transparency Requirements      | Ministry of Water Resources; PCRWR; Private Sector Leaders (Nestlé, PepsiCo); Chambers of Commerce | Fast-track guidelines requiring industrial water withdrawal and quality reporting, linked to existing SDG reporting frameworks.       | Tackles weak monitoring and private sector accountability, as identified by the brief and Nestlé-SDPI project findings. Transparent reporting builds trust and enables stewardship networks. |

|                                |                                                        |                                                                                              |                                                                                                                                   |                                                                                                                                                         |
|--------------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | Enhance Data Integration for IWT Management            | Ministry of Water Resources; IRSA; Ministry of Foreign Affairs                               | Establish an integrated data-sharing platform with India to monitor water flows, usage, and water quality across the Indus Basin. | Data-driven cooperation ensures transparency and builds trust, addressing the gaps in monitoring and compliance, and promoting fair water distribution. |
|                                | Strengthen WASH Delivery Competency                    | Public Health Engineering Departments (PHED); Municipal WASAs; Provincial Health Departments | Deliver refresher training on safe service delivery, quality monitoring, and contamination control to frontline WASH staff.       | Addresses urban-rural service disparities and quality failures noted under SDG 6.1/6.3. Immediate capacity investment improves health outcomes.         |
| <b>Medium-term (3–5 years)</b> | Scaled Wastewater Treatment & Reuse Program            | Provincial WASAs; MoWR; National and Provincial Finance Departments; Private Sector          | Build/upgrade decentralized wastewater treatment facilities; incentivize reuse in irrigation and industry.                        | Responds to underinvestment and near-absence of treatment infrastructure noted in Section 5.4 and PSDI case evidence on FTWs.                           |
|                                | Financial Incentives for Agricultural Water Efficiency | Ministry of National Food Security & Research; Provincial Irrigation Departments; State Bank | Develop targeted financing (e.g., low-interest green loans) for high-efficiency irrigation and crop diversification.              | Responds to SDG 6.4 inefficiencies and low productivity; aligns water and food systems.                                                                 |
|                                | National Water Data Hub & Indicator Platform           | MoWR; PCRWR; Planning Commission; Provincial Data Cells                                      | Create an integrated, real-time data hub for groundwater levels, wastewater flows, quality metrics,                               | Directly addresses data, monitoring, and transparency deficits identified in Section 5.5 and through                                                    |

|                                                  |                                                                |                                                                                  |                                                                                                                                              |                                                                                                                                                                                         |
|--------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  |                                                                |                                                                                  | ecosystem health, and non-revenue water.                                                                                                     | VNR/BTR analysis.                                                                                                                                                                       |
|                                                  | Formalize Basin-Scale Water Stewardship Bodies                 | MoWR; IRSA; Provincial Governments; Local Stakeholders                           | Legislate multi-stakeholder basin committees with defined allocation, conflict resolution, and environmental flow remits.                    | Responds to IWRM implementation challenges. Basin bodies ensure coordinated, hydrology-aligned governance.                                                                              |
|                                                  | Develop Climate Risk-Based IWT Protocols                       | Ministry of Water Resources; IRSA; National Disaster Management Authority (NDMA) | Develop and implement climate change adaptation protocols in line with IWT to address future hydrological shifts and extreme weather events. | Ensures that the IWT remains adaptive and flexible, taking into account climate change impacts on the shared water basin, promoting both climate resilience and adherence to IWT terms. |
| <b>Long-term Structural Reforms (6-10 years)</b> | Mainstream Water Stewardship Across National Policy Frameworks | Federal Government; MoWR; MoCC; Ministry of Finance; Parliament                  | Embed stewardship principles (transparency, shared metrics, equity) in NWP, NAP, agriculture, and urban development policies.                | Institutionalizes stewardship, aligning long-term planning, budgeting, and SDG reporting.                                                                                               |
|                                                  | Revise Groundwater & Environmental Flow Regulations            | MoWR; Provincial Water Commissions; Supreme Appellate Bodies                     | Update legal frameworks to include enforceable groundwater abstraction limits, metering, licensing, and mandated environmental flows.        | Responds to groundwater depletion and ecosystem degradation. Strengthens compliance and ecological protections.                                                                         |

|  |                                                               |                                                                                        |                                                                                                                                                                |                                                                                                                                                                   |
|--|---------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Establish a National Water Governance Commission              | Federal Government; Parliament; Key Ministries; Provincial Representatives             | Create an empowered commission to oversee integrated water planning, resolve policy conflicts, and ensure implementation of SDG and climate commitments.       | Addresses the brief's structural diagnosis of fragmented governance; provides centralized leadership for coherent implementation.                                 |
|  | Enhanced Basin-wide IWT Governance and Stewardship Mechanisms | Ministry of Water Resources; IRSA; Ministry of Foreign Affairs; Provincial Governments | Legislate the establishment of basin-wide stewardship mechanisms for the entire Indus Basin, aligning local, provincial, and national water policies with IWT. | Strengthens water governance by ensuring basin-wide coordination, resolving regional conflicts, and reinforcing the importance of IWT in national water policies. |

## 10. Conclusion

Water resilience in Pakistan is intrinsically linked to both domestic governance and international agreements, particularly the Indus Waters Treaty. Despite significant strides in policy development and international reporting frameworks, there is still a large gap in translating these efforts into effective on-the-ground outcomes. Institutional fragmentation, limited financing, and weak enforcement mechanisms continue to impede progress. To bridge these gaps, water stewardship offers a powerful framework that aligns SDG targets with practical, community-based action. By embedding shared accountability, transparency, and equitable governance at the basin scale, Pakistan can create a more sustainable and resilient water future. Collaborative efforts across government, the private sector, and local communities, underpinned by a strong regulatory framework, are essential for transforming water governance in Pakistan and achieving long-term water security. Through strengthened diplomatic engagement in transboundary water governance and domestic capacity building, Pakistan can enhance its ability to address both current and future water challenges.

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## 12. Appendices

### Appendix 01

#### Concept Note & Agenda

Gender-Responsive Water Stewardship: Policy, Practice and Pathways

11 March 2026 | 11:30 AM – 1:00 PM (PKT)

#### A. Background and Rationale

Water is fundamental to health, livelihoods, and sustainable development, yet global access gaps remain stark. As of 2022, an estimated 2.2 billion people worldwide lacked safely managed drinking water, 3.5 billion lacked safely managed sanitation, and 2 billion people did not have basic handwashing facilities at home. These deficits undermine public health, economic productivity, and progress toward Sustainable Development Goal (SDG) 6 on clean water and sanitation.<sup>54 55 56</sup>

Pakistan reflects the urgency of this crisis. Recent national and international assessments classify the country as critically water insecure. Depending on the measurement used, only between 39% and 89% of the population has access to safe or basic drinking water, with persistent concerns about water quality, groundwater contamination, and wastewater treatment coverage. Rapid population growth, urbanization, and increasing demands from agriculture, industry, and energy continue to intensify stress on freshwater systems, limiting resilience and compounding inequalities.<sup>57 58</sup>

These pressures are not gender neutral. Globally, in households without water on premises, women and girls are responsible for water collection in roughly seven out of ten cases. Collectively, women and girls spend an estimated 200 million hours every day fetching water, often sacrificing education, income-generating opportunities, safety, and well-being. In Pakistan, rural women frequently walk several kilometres and spend three to five hours per day securing water for their households. This burden contributes directly to school dropout rates among girls, restricts women's participation in paid work, and reinforces structural inequalities.<sup>59 60</sup>

At the same time, women remain under-represented in formal water governance structures at local, regional, and national levels. Global monitoring of SDG indicator 6.5.1 on Integrated Water Resources Management (IWRM) indicates that gender-related dimensions are among the least advanced components of water governance. Around half of reporting countries indicate limited or no achievement of gender objectives within water management policies and plans. The

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<sup>54</sup> <https://www.sanitationandwaterforall.org/tools-portal/tool/jmp-global-database>

<sup>55</sup> <https://www.who.int/teams/environment-climate-change-and-health/water-sanitation-and-health/monitoring-and-evidence/wash-monitoring>

<sup>56</sup> <https://www.un.org/sustainabledevelopment/water-and-sanitation/>

<sup>57</sup> <https://www.wateraid.org/pk/publications/infographic-on-wash-facts>

<sup>58</sup> <https://blogs.worldbank.org/en/water/women-in-water-in-pakistan-shows-the-way>

<sup>59</sup> <https://www.unesco.org/en/wwap/gender>

<sup>60</sup> <https://www.who.int/news/item/06-07-2023-women-and-girls-bear-brunt-of-water-and-sanitation-crisis--new-unicef-who-report>

disconnect is clear: those most affected by water insecurity are often least represented in decision-making processes. Yet evidence from Pakistan and other regions demonstrates that when women participate meaningfully in water user associations, village water committees, and governance platforms, outcomes improve. Projects show stronger institutional accountability, better-maintained infrastructure, improved cost recovery, and greater sustainability. Gender-inclusive water stewardship is therefore not only a matter of equity aligned with SDG 5 (Gender Equality), but also a strategic imperative for achieving durable progress under SDG 6.<sup>61 62</sup>

As the global community approaches World Water Day (22 March), the Sustainable Development Policy Institute (SDPI) is organizing this webinar to provide a timely platform for examining how gender-responsive water stewardship can be operationalized within policy frameworks, institutional systems, financing mechanisms, and monitoring processes. The dialogue aims to move beyond formal commitments toward practical, evidence-based pathways that strengthen both water security and gender equality in Pakistan and beyond.

## B. Objectives

The webinar aims to:

- Examine why gender-responsive approaches are essential for effective water stewardship.
- Identify policy gaps and institutional barriers limiting gender integration in water governance.
- Showcase practical experiences and case studies demonstrating successful approaches.
- Propose pathways for embedding gender responsiveness into water planning, implementation, and accountability frameworks.
- Strengthen multi-stakeholder dialogue between policymakers, practitioners, researchers, and development partners.

## C. Key Themes

|                         |                                                                                                                                                           |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Policy</b>           | How national and regional frameworks address (or fail to address) gender dimensions in water governance.                                                  |
| <b>Practice</b>         | Experiences from field implementation i.e., what works, what does not, and why.                                                                           |
| <b>Pathways Forward</b> | Institutional reforms, financing mechanisms, accountability tools, and monitoring indicators that can operationalize gender-responsive water stewardship. |

<sup>61</sup> [https://www.cif.org/sites/cif\\_enc/files/rising\\_tide\\_-\\_new\\_look\\_at\\_water\\_and\\_gender.pdf](https://www.cif.org/sites/cif_enc/files/rising_tide_-_new_look_at_water_and_gender.pdf)

<sup>62</sup> [https://www.worldvisionphilanthropy.org/hubfs/resources/UNC\\_Women\\_in\\_Water\\_Committees.pdf](https://www.worldvisionphilanthropy.org/hubfs/resources/UNC_Women_in_Water_Committees.pdf)

## D. Target Audience

This webinar is designed for:

- Government officials (water, environment, planning, gender ministries)
- Development partners and UN agencies
- Civil society organizations
- Academic and research institutions
- Water utilities and private sector stakeholders
- Students and early-career professionals in water and sustainability sectors

## E. Expected Outcomes

Participants will leave with:

- Enhanced understanding of gender-responsive water stewardship frameworks
- Identified entry points for reform within policy and programmatic structures
- Practical recommendations for institutional integration
- Strengthened collaborative networks aligned with inclusive water governance

## F. Proposed Agenda

| Time             | Session                                                                                                                                                                                                                  | Speaker                                                                 |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 11:30 – 11:40 AM | Welcome Remarks & Setting the Context<br>— Overview of Pakistan's water insecurity landscape<br>— Gendered dimensions of water access and governance<br>— Linkages with SDGs 5 & 6 and World Water Day                   | Dr. Zainab Naeem, SDPI                                                  |
| 11:40 – 11:55 AM | Session 1: Technical & Institutional Dimensions<br>— Data systems, monitoring, and SDG 6.5.1 gaps<br>— Gender in integrated water resources management (IWRM)<br>— Implementation constraints within public institutions | Mr. Ehsan Ul Haq Leghari, ADB                                           |
| 11:55 – 12:10 PM | Session 2: Policy & Governance Perspectives<br>— Civil society advocacy for inclusive water governance<br>— Participation, accountability, and gender mainstreaming gaps<br>— Strengthening policy-practice linkages     | Ms. Sanaa Zulfikar, Hisaar Foundation                                   |
| 12:10 – 12:25 PM | Session 3: Scaling Inclusive Water Stewardship for Community Action<br>— Field-level experiences in gender-responsive water initiatives<br>— Scaling community participation                                             | Ms. Maryam Eqan, WWF<br><b>Mr. Haziq Khan</b> , Kochi Core Centre Japan |

|                         |                                                                                                                                                                                                                                                                                                             |                                                 |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
|                         | <ul style="list-style-type: none"> <li>— Public-private collaboration in shared water risk management</li> <li>— Embedding gender equity within stewardship partnerships and supply chains</li> </ul>                                                                                                       |                                                 |
| <b>12:25 – 12:40 PM</b> | Moderated Discussion <ul style="list-style-type: none"> <li>— Policy gaps and realistic reform options</li> <li>— Institutional enablers and barriers</li> <li>— Audience questions</li> </ul>                                                                                                              | Moderator: Ms. Amna Urooj, SDPI<br>All Speakers |
| <b>12:40 – 12:50 PM</b> | Chief Guest Address: Policy Commitment & National Priorities <ul style="list-style-type: none"> <li>— Integrating gender in national water strategies</li> <li>— Institutional responsibilities and reform priorities</li> <li>— Aligning water stewardship with climate and development agendas</li> </ul> | Dr. Shezra Mansab Ali Khan Kharal, MoCC&EC      |
| <b>12:50 – 1:00 PM</b>  | Closing Remarks & Vote of Thanks                                                                                                                                                                                                                                                                            |                                                 |